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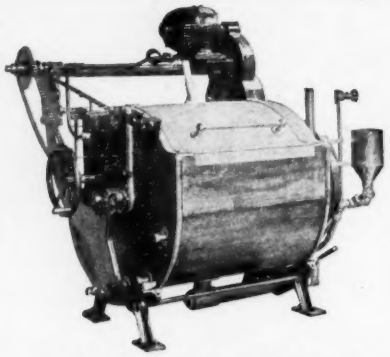

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VOLUME XIII NEW YORK, AUGUST 11, 1924 NUMBER 13

The Elimination of Variables in the Dyeing Method of Testing Dyes*

Introduction—Purpose of the Work—Variables to Be Considered—Proposed Method of Eliminating Variables—Apparatus Employed—Results Indicated—Summary

By WILLIAM D. APPEL

Chemist, Bureau of Standards

THE outstanding advantage of the dyeing method of testing the tinctorial strength and quality of commercial dyes over titanous chloride titration and spectrophotometric analysis lies in the fact that the dyeing method parallels the method of use of the dyes. It involves the direct application of the coloring matter to the fiber on which it is to be used and a visual evaluation of the color of the dyed fiber. Because of this adadvantage the method is the one generally used and, for the large majority of dyes, must be regarded as the standard method.

In the scientific sense, however, the method is anything but standard. There are a large number of variable factors in laboratory dyeing which make the duplication of results from day to day with the same fiber, dye and dyeing method virtually impossible. For this reason the method is strictly a comparative one. The standard and the sample in question are dyed side by side in the same dye bath on two portions of the same batch of fiber. The assumption is made that the two dyeings are heated uniformly; that loss by evaporation is alike in the two pots; that they are worked alike—in fact, that they are dyed under exactly the same conditions.

Purpose of the Work

The object of the present work was to devise a laboratory method of dyeing which would eliminate the variables or make their control possible, so that results might be duplicated at will. It is proposed to use the method in a study of the relative importance of the various factors that enter into laboratory dyeing and to compare other methods for the determination of strength and quality of dyes with the usual dyeing test. The method wi'l be used for dyeing material for reflection and transmission measurements.

Variables to Be Considered

The first variable in laboratory dyeing, or any dyeing, is the fiber itself. Although the fiber used in comparative dyeing is presumably all from one lot, one cannot be certain that a 25 or 50 pound lot of cotton or wool is perfectly uniform throughout. Part of it may have come from a different source or received different preliminary treatment, and as a result have somewhat different dyeing properties from the other part. The factors of size, twist and ply, if yarn is used, and also weave if cloth is used, have a marked influence on the apparent color of the material, and may be particularly important when the color of a limited area of the material is to be measured.

Then, there are the variables in the dyeing operation. The initial and final temperatures of the dye bath, the rate at which the temperature is raised or lowered, and uneven heating may be mentioned. The way in which the various ingredients are added to the dye bath undoubtedly has some influence on the resulting dyeing, and the way in which the fiber is worked in the bath is especially important for uniform penetration and even dyeing. It would seem to be almost impossible to maintain all parts of a skein under exactly the same conditions when the ordinary method of turning by hand is used.

Another set of variables is involved in rinsing, wringing and drying.

Finally, the conditions under which the dyeings are

*Published by permission of the Director of the Bureau of Standards, U. S. Department of Agriculture, and presented before the Dye Division at the sixty-seventh meeting of the American Chemical Society, Washington, D. C., April 21 to 26, 1924.

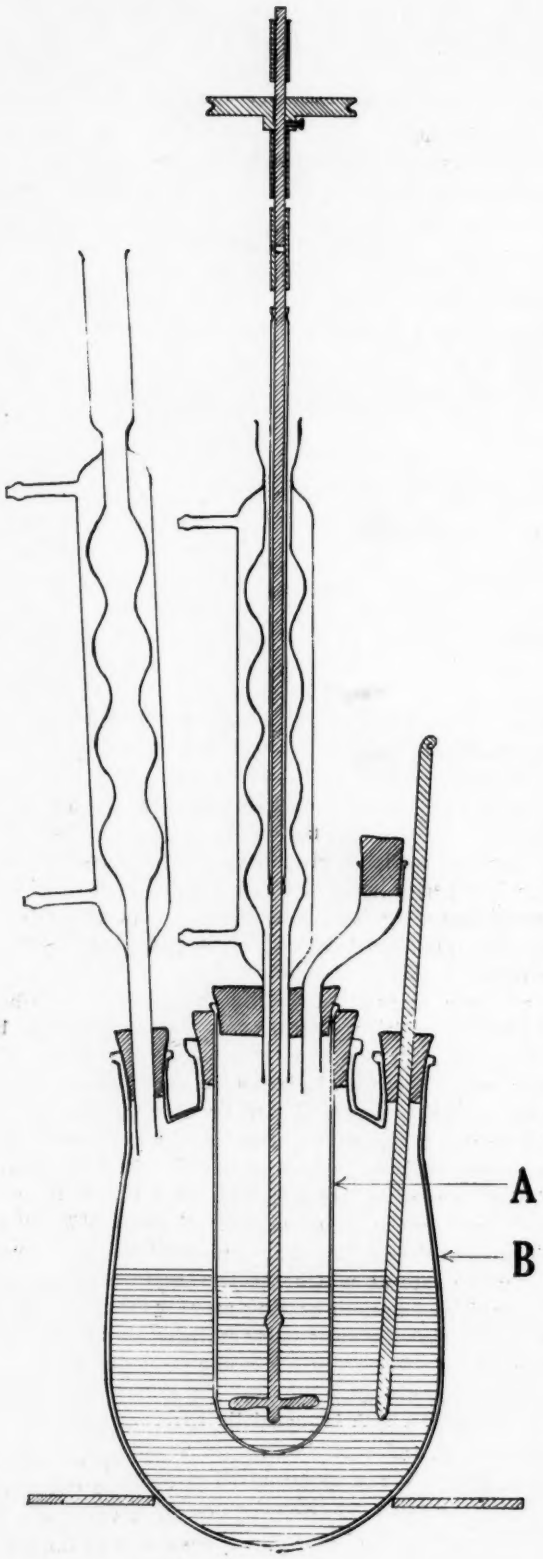


FIG. 1—*Dyeing Apparatus*

compared are known to have a decided influence on the accuracy of the ratings. The intensity and spectral distribution of the light (daylight is most variable), the color of the surroundings and of colored materials just viewed, and eye fatigue are all variables in the dyeing method of testing dyes for strength and quality.

PROPOSED METHOD OF ELIMINATING THE VARIABLES

The proposed method of eliminating the variables may now be described. In the absence of standard, reproducible grades of cotton and wool, sufficiently large batches of good-quality cotton and wool must be prepared for a series of tests or, if the method finds wider use, for the industry at large. The fiber is well scoured and washed in the usual way, and then cut into short lengths. For this purpose a paper beater was first tried. It was found that wool skeins cut into one-quarter to one-half inch lengths with scissors were satisfactorily cut up in a small experimental beater in fifteen minutes. The objection to this method is that the fiber is more or less bruised and broken, and that hydration or other changes may take place. Cotton fiber required longer beating and its nature was changed in the process.

A second method of cutting up the fiber gave fairly satisfactory results. The wool or cotton in skein form was cut into one-eighth to one-sixteenth inch lengths with scissors. It was then suspended in water and agitated very rapidly with a mechanical stirrer. With a loose material such as roving, five minutes' stirring was sufficient to disintegrate the threads and make the mass uniform. The fiber was then collected on a screen, dried, normal moisture restored and the batch mixed thoroughly and bottled. The batch was presumably quite uniform throughout.

Flock cutting machines of laboratory size are not available, but a flock cutting machine should be the most suitable device for this work. Samples of commercial flocks have been used with very promising results.

Whatever the method of cutting may be, a fiber is required which will stir without tangling or balling in the volume of water ordinarily used for the dye bath. It must give a uniform surface when felted out on a screen or when pressed out between glass plates. The fiber must, of course, be free from dirt or particles which will not dye, and it should be representative of good grade fiber in its dyeing properties. It is not necessary, however, that it take exactly the same percentage of dye as the ordinary uncut fiber, or that it have exactly the same hue as ordinary uncut fiber would have when dyed under the same conditions. The test is not designed to tell how much dye to use in the mill, but simply to make possible a strict comparison of standard dye and sample under the same conditions.

The dyeing apparatus is shown in Fig. 1. It con-

sists of an inner dye cup A, which is a 2¼ x 9-inch test tube equipped with an agitator, reflux condenser, and adapted for the introduction of the various solutions. An outer jacket B equipped with a reflux condenser and thermometer contains a liquid whose boiling point is the temperature at which dyeing is to be carried out.

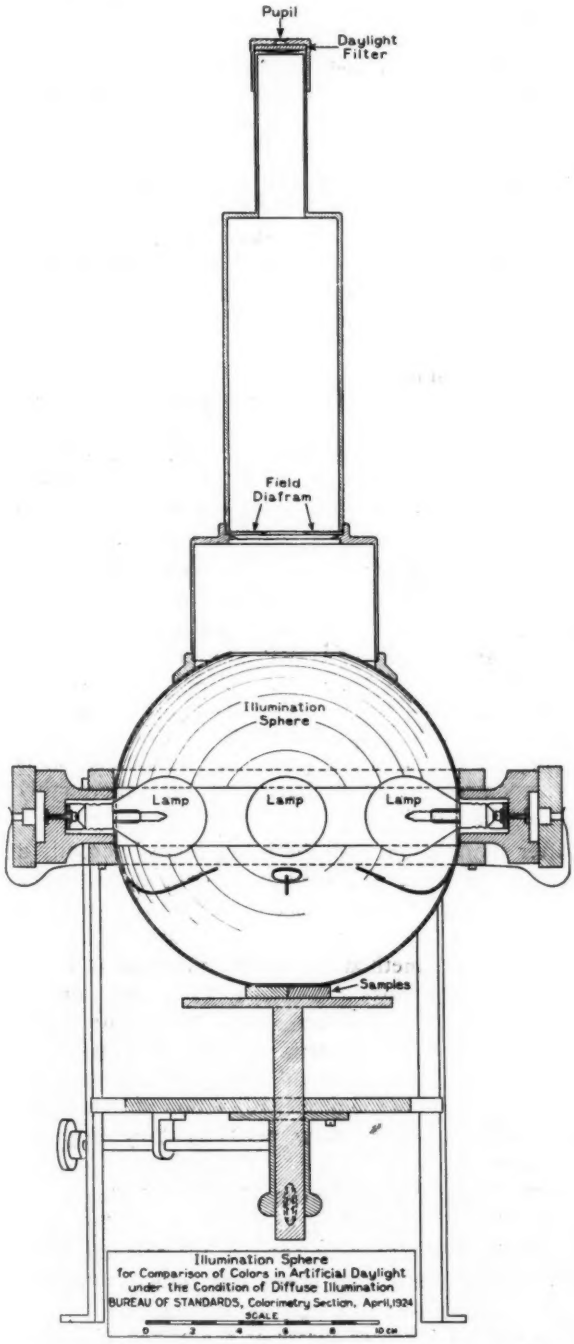


FIG. 2—*Illumination Sphere for Comparison of Colors in Artificial Daylight Under the Condition of Diffuse Illumination*

The outfit is set up in such a way that the dye cup can be easily removed from it. The apparatus may readily be modified to allow of heating a half dozen or a dozen dye cups in one outer jacket at the same time.

The dyeing method will, of course, vary with the dye, but each step is clearly definable and capable of exact duplication. In general, the fiber and a definite amount of water are placed in the dye cup, the agitator is started, and the bath is heated to the constant temperature obtained by boiling the liquid in the outer jacket. The fiber is thus thoroughly wet out. Then the dye in a definite amount of water at a definite temperature is added and other additions to the bath are made in the same way. Owing to the good stirring, dyeing can be started at the optimum dyeing temperature and in some cases at least need be continued for only a very short time. When the dyeing is finished, the dye cup is removed from the apparatus, its contents are emptied on to a felting screen and allowed to drain. If washing is required, the screen containing the fiber is placed in a dish of water, which rises in the screen to a given height. The fibers are stirred with the water and again drained or sucked as dry as possible. The felt is then removed from the screen, placed between sheets of filter paper, and pressed between blotters in a screw press. It is dried in an air bath and may be conditioned if desired.

The dry material is obtained in the form of a felt or a loose flock which presents a smooth surface when pressed out with a glass plate. In either case the dyeings are particularly well suited for comparison. They are perfectly uniform and may be placed in close juxtaposition very much as rub-out tests of pigments in oil are placed side by side on a glass plate or sheet of paper.

Although no work has been done on the best method of comparing the dyeings, an arrangement devised by I. G. Priest, of the Bureau of Standards, may give satisfactory standard conditions of illumination. In its present form (see Fig. 2), which is in no sense final, it consists of a hollow sphere lined with white and illuminated by means of one or more concentrated filament tungsten lamps. The samples to be compared are placed in an opening at the bottom of the sphere, where only the light reflected from the walls of the sphere falls on them. They are viewed through an aperture at the top of the sphere. A daylight filter or other colored screen may be inserted in the eyepiece of the instrument if desired.

RESULTS INDICATED

In this method the conditions of dyeing are under close control If a supply of the *same* lot of fiber were available, workers in different laboratories should be able to produce identical dyeing results with the same dye and be able to duplicate at will. It is believed that the ease of comparison of the dyeings should make for more accurate ratings and much less eye fatigue.

Experimental work in connection with the method is in a preliminary stage, but the indications are that the dyeing time may be very much shorter than that required by the ordinary method. The method does not attempt to duplicate any one practical method of application, and results from it are not expected to be identical with those obtained by dyeing in the mill; but it does make possible a standard procedure for testing dyes for strength and quality.

SUMMARY

The variables involved in laboratory dyeing are enumerated and a method which will eliminate these variables is described. It is proposed to dye loose fiber cut into very short lengths in a closed dye bath equipped with reflux condenser and agitation in the bath. The temperature is controlled by means of an outer jacket containing a liquid of constant boiling point. The method should make possible the duplication of results and lead to improved standard dyeing methods for testing the strength and quality of dyes. Dyeings prepared by the method are particularly well suited for reflection and transmission measurements.

The Singeing of Cotton Fabrics

Why Singeing Is Necessary—Types of Singeing Machine—The Stationary Plate Singer—A Recent Development—Construction and Use—Advantages

By JOHN T. TRAVIS

MUCH has been written with regard to the actual practice of singeing, but in order to understand clearly why singeing is so necessary a process in the converting of cotton fabrics it is advisable also that the processing of cotton before it reaches the fabric stage be considered.

The cotton is delivered to the cotton mill as a mass of loose fibers packed tightly together, and these fibers vary in length from 1 inch or less to 3 inches or over, the average length of the fibers being 1 inch and 1½ inches in the medium grades.

The intent of the manufacturer is to place this mass of irregularly placed fibers in perfect alignment with each other, and then, by twisting them together, to form a continuous thread or yarn of a given size or count.

It will be readily understood without going into further detail as to the processes of carding, combing, spinning, etc., that, on account of the many fibers which the yarn contains, it is quite natural that the ends of the individual fibers may protrude from the body of the yarn, although the greater part of each fiber has been more or less perfectly aligned and twisted in. It naturally follows that in order to show an even yarn these protruding ends must be eliminated, and we therefore have what are known to the trade as yarn singers. These machines consist of a series of open low-heat gas burners, and the yarn is drawn through the flame at a speed that enables the flame to singe off the loose ends of the fibers without materially affecting the tensile strength of the yarn.

We find, however, that when the yarn is made into the woven fabric there occurs a further "roughing up" of the yarn, caused by the friction of the harness and reed through which the warp yarns must pass in the process of weaving. This is not so apparent in the case of "ply" yarns, but is quite noticeable on "singles."

In order that this "roughing up" may be prevented as much as possible in the weaving process, slashing of the warp is resorted to, which is a sizing operation having for its purpose the covering of the yarn with a glue or starch solution, eliminating much of the fraying of the yarn in the weaving process, besides giving to the yarn more tensile strength.

It will be readily understood, however, that while the slashing of the warp may lay the fibers temporarily and prevent much further "roughing up" in the weaving process, it will also have the effect of preventing the thorough singeing of the fabric after it is woven, unless the goods have first been thoroughly cleansed before singeing.

After the fabric leaves the loom, there is usually a great deal of "fuzz" apparent on the face of the goods, due to the abrasion of the yarn in the weaving process, and this occurs not only in the warp but also in the filling as the yarn is fed from the shuttle and interwoven with the warp.

It is generally conceded that it is impossible to obtain a satisfactory luster on fabrics which have not been properly singed, and this is due to the fact that the "fuzz" prevents the proper refraction of light from the fibers, no matter how perfectly they may be aligned.

It is quite possible, however, in the finishing process, by sizing, calendering, etc., to temporarily "lay" any fuzziness which may appear, but this does not produce a true luster or sheen but rather a "shine" which on most fabrics is very objectionable.

The natural inherent luster of the cotton fiber can only be shown by the perfect alignment of the fibers, and then only after the fibers have been thoroughly

cleansed from all impurities and the "fuzz" eliminated by a proper method of singeing the woven fabric. This permits the true refraction of light from fiber to fiber, which in reality is luster.

Many types of singeing appliances have been used by finishers, with more or less success, in their efforts to obtain the desired result, and much research work and effort have been applied to the problem of singeing by both foreign and domestic makers of singeing machinery.

Before commenting further on the various types of singeing machines devised, it would be well to mention that it is generally conceded by the best authorities that the ideal singe is not a burn, as it is quite possible to burn the face of a fabric without thoroughly singeing the yarns of which the fabric is made. This is clearly demonstrated by the fact that a poorly or improperly singed cotton fabric will show a dirty or blackish tone, while the true singe imparts to the fabric a light golden-brown tint which is readily boiled off or bleached out.

It is also generally known that an unevenly singed fabric will show up unevenly after dyeing.

Types of Singeing Machine

The earlier types of singeing machines were devised for the use of soft coal or charcoal as the heating medium. In the case of the revolving plate or roller singer, the flames from a furnace in close proximity to the singer roll were drawn through the hollow roller by the draft of the high chimney and it was necessary that the flames from the soft coal so used be intense enough to heat the roller from the inside to a sufficient degree to show a red heat on the outside of the revolving roller. Naturally, this was found to be an expensive method of heating, and it was hardly possible to heat the roller uniformly, as the most intense heat was naturally at the end of the roller nearest to the furnace. This very naturally produced an uneven or "ombre" effect in singeing and, while one edge of the fabric might be singed perfectly for a short distance in, the singe "faded off." In order to overcome this defect it was found necessary to reverse the direction of the goods by a second singeing operation, but it will be readily seen that this would not produce an even singe across the entire fabric.

On this type of singer a cast-iron roller was used, but the red rust forming as a result of the oxidation of the metal was very objectionable, as this rust or scale was carried off by the cloth and resulted in "rust spots" in the after-processing. On account of the unevenness of the heating of this metal, unevenness of the surface of the singer roller developed and in many cases buckling or even collapse of the roller occurred.

Oil as a heat producer has also been applied to singeing machines, but many objectionable features to this method of heating have been found.

Another method in use in more recent years was the charcoal heating system used under the convex stationary plate, and many of these are in use at the present time, although most have been supplanted by the more modern method of gas heating.

The types of singeing apparatus most generally in use at the present time are the open-flame singer and the stationary plate singer, and the majority of these are heated by gas, although some are heated by oil.

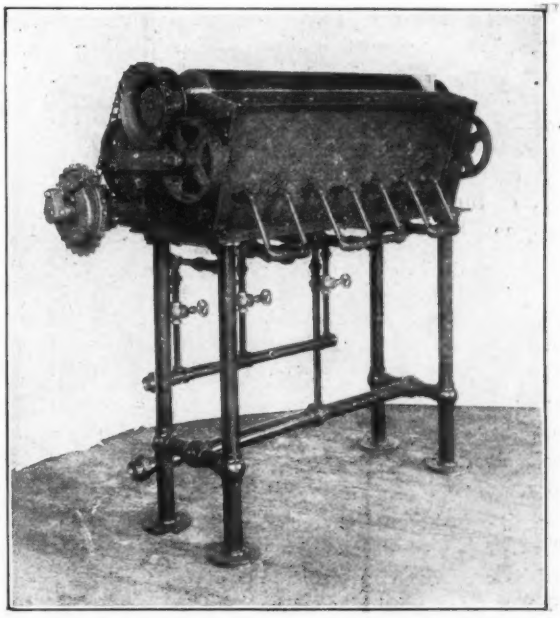
The open-flame gas singer is equipped with a series of tip burners set closely together for practically the whole length of the burner pipe, and gas and air in proper proportions are fed to the tip burners under pressure, this pressure being controlled by valves in order to supply the correct mixture necessary for satisfactory combustion, and to furnish also the heat intensity desired.

Another type of open-flame burner consists of what is known as a ribbon burner, the pipe being so perforated as to furnish a solid sheet of flame the entire distance of these perforations. Both of these types are said to be quite efficient and satisfactory where a flame of only moderate heat intensity is required.

The Sanitary Plate Singer

For use on fabrics where heat intensity is of prime importance, however, the stationary plate singer has been most generally installed, and this is also used in conjunction with ribbon or tip burners to render the plate singeing more effective and to assist in speeding up production.

Convex plates of about 1½ inches in thickness are used, and these are supported by metal or brick work and the flame from pressure gas or gas with air pres-



sure is applied underneath the plate. By this method it is possible to maintain a heat intensity across the entire plate of 1,400 to 1,500 deg. Fahr. The plates so heated are of copper, hammered to give additional tensile strength to an otherwise relatively soft metal.

Hammered copper has been found to be more satisfactory for this purpose than many other metals, on account of its great heat conductivity and ready heating from underneath the plate and, of course, on account of the absence of red rust oxidation, which occurs when iron or steel is used for the stationary plates.

It is found, however, that on copper oxidation begins at about 360 deg. Fahr. and the metal throws off a dark scale with which the fabric is bound to become more or less contaminated. It is to be noted also that when heated the tensile strength of copper is very much reduced, the loss being approximately 43 per cent of its tensile strength at 1,400 deg. Fahr. This therefore renders the plate liable to buckling or even collapse at extreme heats, and the oxidation of the copper metal is also a very objectionable feature. The oxidized particles not only weaken and disintegrate the body of the metal, but these particles are more or less carried off by the fabric and are present in the after-processes of bleaching, dyeing, etc.

Another objectionable feature of the oxidation of the copper metal is that the particles tend to form heat insulation between the metal and the fabric to be singed, thus interfering with the efficiency of this method of singeing.

The fabric to be singed is passed rapidly over the stationary plate, but in reality comes into contact with only a small portion of the heated plate, as actual contact is not more than about 4 to 5 inches of the entire surface of the plate. The entire plate is, of course, heated to the same intensity as the contact point, and this would seem to indicate a considerable waste of heat considering also that the most intense heat is on the under part of the plate, where contact with the fabric cannot be had. The cooling effect of the contact of the fabric with the plate would also seem to indicate that the coolest part of the plate is actually where the heat is most necessary and the hottest part where it is practically of little or no use in so far as the actual singeing of the fabric is concerned.

A Recent Development

A new type of singeing machine has recently been devised to overcome the many disadvantages mentioned in the foregoing, and it will readily be observed that in the new apparatus as shown in the illustration a dependable singeing machine is now available as the result of the intensive research work of one of the leading gas concerns, which is the inventor and maker of this machine and of the auxiliary apparatus needed for its successful operation.

A high heat-resisting material, nichrome, is used in the construction of the singeing cylinder. Nichrome is not a steel but an alloy. Its principal constituents are nickel and chromium, the non-oxidizing properties of the alloy being due to its high percentage of chromium. Nichrome shows practically no oxidation below a temperature of 2,000 deg. Fahr. While this material is guaranteed for a life of 5,000 hours at a temperature of 1,400 deg. Fahr., there are a number of instances where nichrome castings being subject to rough usage have lasted for 12,000 hours at a temperature of 1,600 deg. Fahr., which, of course, is a considerably higher temperature than that used in singeing work.

At 1,500 deg. Fahr. the tensile strength of cast nichrome is 24,500 pounds per square inch, whereas copper has only about the same tensile strength even at normal temperature—that is to say, cold.

The nichrome cylinder over which the cloth passes is so constructed that it will not sag or collapse, so that the contact surface between the cloth and the nichrome singeing cylinder always remains the same. The length of the singeing cylinder is, of course, made to suit the width of the cloth to be processed.

The fact that the nichrome cylinder rotates at about four revolutions per minute in the direction opposite to that of the moving cloth assures that a freshly heated surface is constantly brought into contact with the goods, thereby assuring uniformity of singeing.

The outside area of the nichrome cylinder—in other words, the surface making contact with the cloth—is continuously heated directly. This latter circumstance, together with the fact that, on account of complete absence of scale, a highly polished contact surface of the nichrome cylinder is maintained and that this contact surface of the cylinder remains straight (is not subject to bending), accounts for the very efficient operation of the machine and for the superior quality of the singeing.

The heating chamber is lined with high-grade refractory tile, and is so designed that with the burner arrangement as chosen a uniform temperature may be maintained in all parts of the heating chamber, assuring, in turn, uniformity of temperature of the nichrome cylinder surfaces.

The compactness of this singer as a complete unit eliminates the cost and maintenance of expensive brickwork and furnaces as used on other types of stationary plate singers which are heated by either coal, oil or gas, besides effecting a considerable economy in the matter of floor space.

Also, this type of singer may be installed to replace any other type, without in any way affecting any apparatus or equipment now in use for the passage of the goods.

This machine can be built to be used with any modern method of gas firing—that is, to suit the burners

(*Continued on page* 523)

What Do We Know About Sizing Paper With Rosin?

Variable Factors Influencing Results—Nature of Rosin—Nature of Alkali Used—Degree of Saponification —Additions to Size—Variations in Emulsions—Nature of Fibers

By E. SUTERMEISTER

DO not start to read this paper with the idea that it contains a lot of new or revolutionary information. It is possible that here and there in it the reader may find a new idea or at least a new point of view, but for the most part it is written with the intention of reviewing what we know, or rather do not know, about the rosin sizing of paper. It might be contended that there are already too many papers of this sort in the technical journals, but it can do no harm to look over our stock in trade and it must also be remembered that there are always newcomers in the industry to whom a review of this sort may be a very distinct benefit.

What do we really know about rosin sizing? Considering the length of time that the process has been in use since it was first introduced by Illig in 1806, and considering also the information which should have been collected during this period, it must be admitted that we know practically nothing. This is not from a mistaken idea that the problem was not worthy of investigation, for an immense amount of time has been spent in researches relating to it and it is highly probable that many of the investigators would take exceptions to the statement that we still know practically nothing about it. In looking over the work which has been done the outstanding feature of the situation seems to be that there is no general agreement among different observers; occasionally two may be found who agree on a single point, but more often it is every man for himself with agreement conspicuous by its absence. What is worse than this, though it is seldom admitted by any investigator who cares much for his reputation, it is often found that tests made in the same way frequently give diametrically opposite results. This is not so often true with laboratory tests as it is with trials made on a mill scale, but in the latter case it is of such frequent occurrence as to be a very disturbing factor in such investigations.

Variable Factors Influencing Results

Looking over the operations involved in rosin sizing, it is seen that there are a large number of factors which may have an important influence on the results obtained. Operations may be classified broadly in three groups, as follows: (1) Preparation of the sizing materials for the beater; (2) operations in the beater, and (3) operations on the paper machine. Without making too exhaustive a search, and without straining matters in any way, the variable factors in each group which may affect the sizing results can be listed as follows:

Preparation of Sizing Materials

1. Kind and grade of rosin and variations in quality within any grade as acid number, saponification number, unsaponifiable matter, etc.

2. Nature of the alkali used, whether caustic soda, soda ash, sodium aluminate, sodium silicate, etc.

3. Variation in the degree of saponification of the rosin all the way from a so-called neutral size to one high in free rosin.

4. Possible additions to the size, either during or after cooking, as glue, starch, casein, tannin, etc.

5. Variations in the preparation of the solution of emulsion, resulting in solutions ranging from nearly clear to almost opaque.

Operations in the Beater

6. The nature of the fibrous stock used: rag, sulphite, soda, kraft, or ground wood.

7. The degree of beating to which the fibers have been subjected.

8. The kind and amount of filler used and possible variations in their chemical composition or in the impurities present.

9. The nature of, and variations in, the water supply.

10. The presence of lime salts in the bleached fiber or added when using waste coated papers containing satin white.

11. The method of adding the size to the beater, thick size or an emulsion of varying degree of strength.

12. The time of adding the size; early or late in the beating process, before or after the alum, etc.

13. The proportions of size and alum, both to the rest of the stock used and to each other.

14. The nature of the alum, whether acid or basic in character.

15. Substitutes for alum, as magnesium or zinc sulphates, acids, etc.

Operations on the Paper Machine

16. The intensity of the suction applied to the sheet on the wire.

17. The number of presses used and the pressure applied.

18. The speed of the machine.

19. The thickness of the paper being run.

20. Dryers: temperatures individually and as a series, and variations occurring in their operation or efficiency from day to day.

21. Dryer felts: kind, weave, tightness, proportion of dryer surface covered, etc.

22. Steaming or pressing between banks of dryers.

23. Calendering on machine calenders or later on super-calenders.

It is quite probable that in making out this list some factors which might influence sizing results have been overlooked entirely. No claim is therefore made as to its completeness and the reader is at liberty to add such items as occur to him. But even twenty-three factors which are either known to influence the results or are strongly suspected of doing so are enough to cause a very considerable amount of trouble in carrying out investigations of the sizing process. In tests conducted on a plant scale many of them cannot be controlled without interrupting production to a serious extent, while with others—as, for instance, the temperature of the dryers—there is no entirely satisfactory means for even observing and recording conditions during a test. This is one of the chief reasons for considering the results obtained on a laboratory scale more reliable than those of mill tests. In the laboratory there is no question of production; the cost of any special equipment is comparatively small; if a batch of stock is spoiled no great loss is incurred; and, best of all, conditions can be much more closely controlled and full attention given to the test itself. On the other hand, there are some mill conditions which cannot be duplicated in the laboratory, and in such cases all that can be done is to get the best results possible from a mill test. It is also unfortunately true that the man in charge of manufacturing operations will accept the results of a mill test, while of a laboratory test he is apt to say, "Yes, you can do that in the laboratory but it can't be done in the mill." That is unfortunately true in many cases, but it simply means that conditions in the mill cannot be economically adjusted to duplicate those of the small-scale test, and not that the results obtained in the laboratory are incorrect. If desirable results are obtained on a small scale it sets up a standard for large-scale operations to equal.

The large number of variable factors which influence sizing is doubtless responsible for the slow progress which has been made in placing the operation on a sound scientific basis, and also for the variations and disputes between different experimenters. While one may give what he considers all the essential information, when the next experimenter tries to repeat the work he is very apt to find that the details are not quite sufficient to enable him to follow exactly in the other's footsteps. As illustrations of such cases, it is quite impossible to describe the degree of beating of an engine of stock so that another person can duplicate it (in fact, it is seldom that the same person can duplicate his own work along this line), also the condition of the water used is often not taken into consideration, or at least not fully described, so that two persons may think they are carrying out parallel tests while actually conditions may be quite different.

With these few preliminary remarks in mind, let us consider the variable factors, one at a time, and see how they are supposed to influence sizing and, so far as may be, what the different opinions are as to their relative importance.

Nature of Rosin

It was formerly considered that a medium dark rosin, such as F or G grade, was best for paper sizing because the higher temperature of distillation left less pitch in the rosin. Witham goes even further and says that the sizing value of D or E grade rosin is higher than that of F or G, and that D and E are to be preferred if their dark color is not harmful. Haug, on the other hand, says that the lightest colored rosin is generally best suited for sizing. Experiments in at least two laboratories proved that very light rosin, such as WW, had more sizing power than F or G, but when the WW rosin was used in the mill it was found that it was at least no better than F and in one case was considered decidedly inferior to the latter. It is, of course, not known whether the WW rosin used in mill operations was the same in all respects as that for the laboratory tests, nor is it certain that mill conditions were as favorable as those of the small-scale trials. It is certain, however, that it did not work out well in the two cases in which it was tried.

The properties of the rosin, as the acid number, the saponification number, etc., are supposed to influence its sizing value, but it is very doubtful if enough information is available to establish any facts. Schwalbe claims that the material insoluble in petroleum ether has no sizing value, and that its amount should be as low as possible; he also states that unsaponifiable matter in the rosin is harmful, because it coarsens the emulsion. Haug, however, finds the presence of unsaponifiable matter to be without influence on its sizing value.

Zhereboff indicates a method of attacking the problem of the nature of rosin and variations in its composition by fractional neutralization or by dissolving it in a mixture of petroleum ether and ethyl or methyl alcohol, and then adding a few drops of water. This latter method causes the solution to separate into two layers which contain substances of quite different properties. Zhereboff found that the two portions, when used in alcoholic solution, possessed vastly different sizing power, the tests being made by dipping

strips of paper in the solutions and drying at 80 deg. Cent.

It is evident at the very beginning of this resume that variations in the chief raw material used in sizing are suspected of having more or less influence on the results obtained, yet there is a great lack of conclusive evidence on this phase of the subject and no uniformity of opinion as to how, or to what extent, they modify its sizing properties.

Nature of Alkali Used

The use of soda ash is almost universal in size making, probably because it is cheap, easily handled and readily obtained in a high degree of purity. From time to time it is proposed to use caustic soda instead of soda ash, but it is difficult to see just why it should give any better results, since the final result of cooking the rosin is sodium resinate in either case. Notwithstanding this inability to see the reason, at least one case is known where changing from soda ash to caustic soda caused a very great improvement in the sizing and made it possible to reduce the amount of rosin used.

Sodium aluminate and sodium silicate are sometimes claimed to be superior to soda ash in cooking size because they cause precipitation of alumina or silicates in the beater. These two materials doubtless aid in making the paper harder and more rattly, but they do not make it more resistent to wetting with water and in this sense are not to be considered as sizing agents. The best evidence as to their inefficiency in this respect is to be found in the fact that they have never come into general use as saponifying agents for rosin.

Degree of Saponification

Probably no question relating to rosin sizing has been the subject of so much controversy as that of whether a neutral or high free rosin size gives better results. This is of necessity bound up with the question of whether the real sizing agent is free rosin or aluminum resinate, and neither question can be discussed without the other.

On the side of free rosin as the sizing agent, and hence of a size containing much free rosin, are Wurster, De Cew, Bray and numerous others. On the side of the aluminum resinate theory are Friedlander, Turner, Neugebauer, Heuser, Remington, etc. The advantage has been first with one side and then with the other, but there seems at present to be an ever-increasing weight of evidence against the free rosin theory.

The question is one which is extremely difficult to investigate because it is so complicated by the factors of dissociation, influence of soluble salts or excess of aluminum sulphate, influence of cellulose, colloidal condition of the size itself, etc. Ivanoff finds, for example, that at the dilution of the beater practically all of the rosin is hydrolized to the free state. This is difficult to reconcile with the aluminum resinate theory, for it is hard to believe that rosin once set free in the beater would again combine to form aluminum resinate. Free rosin, precipitated by acid, or from alcoholic solution, is said to have comparatively little sizing power, yet if alum is added after the alcoholic rosin has been thoroughly worked into the fibrous mass very good sizing can be obtained. The effect of sunlight proves that there is a great difference between the sizing produced by rosin precipitated with acid and that from alcoholic rosin followed by alum, the latter being much the more durable.

It has apparently been quite definitely settled that an excess of alum does not decompose aluminum resinate with the formation of free rosin, yet a very considerable excess of alum over that necessary to just precipitate the size is found to be necessary in actual practice. There must be some sort of change caused by this excess of alum, but its nature has not yet been satisfactorily explained. It may be in the nature of an occlusion phenomenon, as suggested by Sieber, who thinks that possibly alumina may absorb free rosin by occlusion, or it may be necessary to complete the coating of the rosin particles according to the theory of Schwalbe, who appears to think that each particle of rosin wears a jacket of alumina.

It seems probable that the question of free or combined rosin size cannot be settled by any general rule which will apply in every case, but it would be very helpful if it could be settled to such an extent that it would be safe to say when to use one and when the other. The most promising line along which to attack the problem seems to be that of colloid chemistry, but it is such a complicated problem that research leading to its solution should be laid out and co-ordinated by a master mind, rather than left to the whims of a number of investigators.

Additions to Size

At more or less frequent intervals someone comes out with a proposal to use some material with the rosin size to increase its effectiveness. In many cases the object of such a proposal is in reality the development of an additional market for the size assistant suggested, but the proposal is usually couched in such plausible language that it sounds very attractive to the mill superintendent. A practical trial therefore has to be made, and unless this covers a considerable period of time the result is still in doubt.

Among the substances suggested as additions to the size, either during its cooking or when it is diluted, are vegetable oil soap, phenanthrene, phenol, tannic acid, glue, casein, starch, albumen, stearine, etc. Vegetable oil soap is said to make the size work better because it gives a finer grained emulsion; but, as will

be shown later, fineness of emulsion does not always go with high sizing efficiency. Tannic acid or tannin-containing materials are claimed to improve the sizing and to make the paper so sized resist the destructive action of sunlight better than when rosin alone is used. Laboratory tests by the writer, using six different tannin-containing materials, failed to show any consistent improvement in sizing and, in fact, most of them gave size-fastness inferior to the sheets in which rosin alone was used.

Starches, either raw or cooked, are practically without influence on the sizing so far as change in rate of ink penetration is concerned. This is quite contrary to the claims of many starch dealers and manufacturers, and under certain conditions they may be right in claiming a benefit from the starch; it is certain, however, that none of the starches tried by the writer has improved the sizing at all. With glue and casein the case seems to be different, and a marked improvement has been found possible by their use. This is probably due to their acting as protective colloids; but whatever the reason, the results are sufficiently promising to justify further work to develop all the facts of the case and to show when and to what extent glue or casein is a benefit.

In considering the advantage to be gained by the use of any assistant to the size it must be remembered that the cost of such additions is often greater than the cost of the rosin saved, and this generally limits their use to papers where a certain sizing degree must be obtained at any cost.

Variations in Emulsions

In considering the effectiveness of size emulsions it is very generally claimed that those with the finest particles in suspension are much better than those with coarser particles. This is equivalent to saying that a size emulsion containing the free rosin in such a finely divided state that it is practically transparent is a better sizing agent than one which is milky and opaque. This is such a reasonable contention that it has probably been accepted as a fact without sufficient demonstration. It is known that in one plant a method of making a practically transparent size emulsion was developed and was most enthusiastically claimed to have cured all its sizing troubles. The same method was tried in another plant and found to give no better results than a milky emulsion.

Under some circumstances, when all conditions are favorable, it is quite probable that the size of the particles might have an influence on the results, but it is also true that conditions most favorable to sizing are seldom encountered. In most plants the bleached fiber used contains enough calcium chloride to precipitate a very appreciable part of the rosin as calcium resinate before the emulsion has a chance to be intimately mixed with the fibers. In others the use of white water for furnishing the beaters supplies enough alum to precipitate much of the rosin at once. Under such conditions it seems hardly reasonable to suppose that the fineness of particles in the original emulsion could have a very great influence on its sizing value.

Nature of Fibers

Very little information is available regarding the relative ease of sizing different kinds or grades of fibers. Turner states that rag pulp is harder to size than sulphite, and that unbleached fibers and groundwood size with greater difficulty than bleached stock. He claims that fiber from fir does not size as well as that from spruce, and that as the oxycellulose present increases the fiber sizes more easily. From another source it is found that bleached soda poplar fiber sizes about three times as easily as bleached sulphite spruce.

It is not known whether these statements would hold true in all cases or whether they are exceptional instances. Neither is there any known reason for such variations, though it is suspected that the chemical residues remaining from the isolation processes may have some influence. Even that is not probable in the case of bleached soda and sulphite fibers, for after bleaching the chemical residues in each would be practically the same.

(To be concluded.)

CHLOROPICRIN USED ON SILK COCOONS

French scientists are smothering silkworm cocoons by chloropicrin, which is displacing heat, according to Paris advices to the American Chemical Society.

"This process, superior so far as cost is concerned and easy to watch compared with the use of heat," says the Paris report, "may bring about an extension in silkworm cultivation, not only in the large centers already existing, but in the regions where there are mulberry trees which would permit the creation of small centers for raising the silkworms."

The cocoons are smothered to break the chrysalis. As a substitute for heat, artificial cold or certain inert gases, such as nitrogen, hydrogen, carbon dioxide, or even toxic gases, such as ammonia, sulphuric acid, or hydrogen cyanide, have been tried. Whether the smothering is too slow with inert gases, or the silk is changed with the toxic gases, acid or alkaline, the results have not been satisfactory.

The results have been very clear and show that the cocoons smothered by the chloropicrin give a silk which, from the point of view of elasticity, tenacity, efficiency of ungumming, does not differ in any way from the cocoons killed by the heat.

Modern Wool Washing

A Detailed Description of a Factory Test with Hydraphthal Which Illustrates How the Modern Wool-Improving Industry Utilizes the Progress Made in Scientific Research

By D. E. POSPIECH

THIS report, which is an authentic description of a factory test with hydraphthal, may serve to illustrate how the modern wool-improving industry utilizes the progress made in scientific research and chemico-technical efficiency.

The experiment took place in a wool-washing establishment which forms part of a worsted spinning plant enjoying an international reputation. The material handled was strongly seedy, burry merino, quality AA, which, according to the statements of specialists, was particularly difficult to wash. A five-bath washing machine with a capacity of 13,000 pounds of wool in sixteen hours was available. The water was softened and the washing agent, a curd-soap which was dissolved originally by direct steam in a stirring boiler of about 211 gallons' capacity, was fed continuously to the individual baths from a high reservoir. Also calcined soda likewise was kept in high reservoirs in stock solution of about 6.6 pounds per 264 gallons. The test was carried out in such a way that hydraphthal was supplied to the washer by hand. When the washing was started, the first, or so-called scouring, bath was filled freshly with five buckets of soap solution, equivalent to 3.3 pounds of soap, and heated to about 48 to 50 deg. Cent. (118 to 122 deg. Fahr.). At the same time, in the baths No. 2 and No. 3 the soda inlet was regulated to feed about 3.05 gallons per minute, and in the baths No. 4 and No. 5 the soap inlet fed 3.2 gallons per minute, after which washing started without any further additions. The The baths No. 2 and No. 3 were kept at about 50 deg. Cent. (122 deg. Fahr.), bath No. 4 at 52 to 53 deg. Cent. (126 to 127 deg. Fahr.), and bath No. 5 at 55 deg. Cent. (131 deg. Fahr.) and above. The temperature in the dryer, as long as no addition was used, had to be 60 deg. Cent. (140 deg. Fahr.), otherwise too much moisture remained in the wool. This is a sign of imperfect washing, since wool dries at a lower temperature the more thoroughly it is degreased. However, 50 deg. Cent. (122 deg. Fahr.) is supposed to represent the maximum, for higher temperatures in the drying apparatus result in more brittle and less easily spun wool. Finally, it is significant that the wool remained in the first bath for eighteen minutes, in the second to fifth baths one-half minute each, and in the drying apparatus for thirteen minutes, making a total of thirty-three to thirty-five minutes for washing. So long as washing was done without any addition, the material left the dryer with a somewhat greasy smell, was yellow and sticky—i. e., imperfectly cleaned—in spite of the relatively high temperature of the baths.

After the washing had continued for one hour without addition, the washing experiment proper was started. The hydraphthal was dissolved, while being stirred thoroughly with warm water into a basic product of 1:10, and added as follows: To bath No. 2, 1.06 gallons 1:10 (0.88 pound); to bath No. 3, 1.58 gallons 1:10 (1.33 pounds), and to bath No. 4, 0.53 gallon 1:10 (0.44 pounds), a total of 3.17 gallons (2.65 pounds). Furthermore, every quarter of an hour additions were made as follows: To bath No. 2, 0.26 gallon 1:10 (0.88 pound per hour); to bath No. 3, 0.53 gallon 1:10 (1.76 pounds per hour), and to bath No. 4, 0.26 gallon 1:10 (0.88 pound per hour), a total of 1.05 gallons (3.52 pounds per hour).

Immediately after the addition of hydraphthal the baths of the washer began to form a fine thick white foam, which was not the case before. It is a fact that the hydrogenated hydrocarbons generally promote the foam formation of the soap and a good foam greatly benefits the mechanical cleaning.

During the further progress of the experiment the washing machine furnished a dry, splendidly open, odorless, non-sticky wool in which particularly the fine, soft feel and the conspicuous whiteness were noticeable. The temperatures of the baths could be reduced to such an extent that the scouring bath kept below 45 deg. Cent. (113 deg. Fahr.); baths No. 2 and No. 3, however, 46 deg. Cent. (115 deg. Fahr.), and baths No. 4 and No. 5 up to 48 deg. Cent. (118 deg. Fahr.). Likewise the drying apparatus could be reduced to 50 deg. Cent. (122 deg. Fahr.). The soap supply was shut off to about one-half the quantity previously required—that is to say, to about 1.3 gallons per minute—in baths No. 4 and No. 5 jointly (see above). The perfectly white color of the wool washed with hydraphthal is attributed to a special quality of the hydrogenated hydrocarbons forming the basis of the hydraphthal. The latter has a reducing effect and therefore bleaches the wool while it is moving through the open air in moist condition impregnated with infinitesimal quantities of hydraphthal in the presence of alkalies. This effect is assisted further by the higher air temperature in the dryer.

The experiment was continued for thirteen hours without there being any difference in the way the

washing turned out. The following table will serve, in conclusion, to sum up the results briefly:

Washing without addition—
Ether extract: 3.03 per cent fat.
Nature of the wool: Sticky, not open, yellow, oily or greasy smell.
Consumption of soap: About 550 pounds in sixteen hours.
Washing with hydraphthal—
Ether extract: 0.68 per cent.
Nature of the wool: Soft feel, open, white, odorless.
Consumption of soap: 292 pounds in sixteen hours.
Hydraphthal: About 55 pounds in sixteen hours.

The results sought in this mill, as stated, were to lower the loss in combing and to produce a wool as soft and as open as possible, besides thorough degreasing. This was accomplished by keeping the temperatures as low as possible and by using plenty of hydraphthal. Furthermore, in the last rinsing bath a little soap was used in order to give the wool a little fat again in the form of soap prior to the drying. In this case less attention was paid to a saving than to getting the finest grade of wool obtainable which could be worked to the best advantage. In each case, when using the hydraphthal process, it must be decided definitely just what it is desired to accomplish: whether a great saving is desired, together with wool which can be easily worked, or whether it is desired to secure wool which is very open and entirely unfelted or unmatted, thus causing less noils. In the former case less hydraphthal is required and normal temperatures are used; in the latter case it is possible to reduce the temperatures below normal, but more hydraphthal must be used and the soap quantities cannot be reduced as much as in the first case. Any specialist, however, will find it an easy matter to adapt the working method with hydraphthal to either of the two examples, according to his special requirements and the peculiar conditions of his establishment.

Scientific Washing

VIII—Water: Its Use in Textile Washing

A Great Cleanser—Impurities—Hardness—Compounds That Cause Water to Be Hard—Impurities Other Than Hardness—Sulphur as an Impurity—Salt Sea Water—Natural Alkalinity of Water—Temporary Hardness—Permanent Hardness—How Hard Water Wastes Soap—How to Soften Water

By F. H. GUERNSEY

Chief Chemist, Cowles Detergent Company

WATER is a chemical. What, then, is to be said of that unwise claim seen occasionally on laundry slips, "We use no chemicals"!

The chemical formula for water is H_2O. Two hydrogens are combined with one oxygen, though the laundry owner must not form the idea that his water supply can be made by simply mixing the two gases. A third factor is necessary to cause them to unite. A mixture of flour, water and yeast would not be very appetizing without the application of heat to cause proper union of the ingredients.

Few of us appreciate the great value of water for washing purposes. We use it and value it highly, of course, but in our application we generally treat it as a neutral medium in which to dissolve and use detergent materials. The fact that the water itself has exceptionally high detersive value is unappreciated.

Water itself is of value as a cleansing agent or detergent because—

1. It is relatively low in cost.
2. It most nearly serves as a universal solvent.
3. Though a chemical compound itself (H_2O), it is practically inert chemically, with respect to textile fibers and the materials of construction employed in the manufacture of laundry machinery.
4. Its surface tension, though fairly high, may be reduced about 60 per cent by the addition of proper materials.

The following discussion emphasizes the importance of the part which water plays in the washing process; also shedding some light upon the influence of impurities which are dissolved or suspended in many natural waters.

Impurities

The textile mill very seldom has the opportunity to wash in *pure* water. On account of its great solvent properties, all natural water is contaminated with dissolved substances. In general, waters from rocky sections are low in mineral content. Those from limestone regions are hard. Those from regions of alkali deposits are high in sodium and potassium. Those from swampy regions are highly colored. Some sec-

tions are the source of surface waters low in mineral content and fairly clear. New England, northern Wisconsin, northern Minnesota and western Oregon and Washington are examples. This fortunate circumstance of nature has largely influenced the location of the textile industry in the localities mentioned. The streams in the Mississippi River basin are muddy, and very hard. Those in the southwest section frequently contain alkali.

Pure water is obtained only by careful treatment. The necessity of securing a pure water has given rise to what is now a relatively large industry—the manufacture of filters, softeners and other water-conditioning apparatus. The familiar zeolite water softener is one device with which the launderer and textile man is concerned. Its invention was a great help to the user of detergents, for aside from the economy in the consumption of detergents which its proper use effects the quality of washing is made better. Every laundry owner whose plant is equipped with water-softening apparatus must remember, however, that continuous watchful care is necessary to its proper functioning.

A given water may be suitable for one purpose and unsuitable for another. For instance, a hard spring or lake water may be satisfactory from sanitary and chemical viewpoints for drinking purposes, yet produce unsatisfactory results in the power laundry where it is used with fat soap. On the other hand, a water of crystal clearness may be most dangerous to drink if it has been contaminated by pathogenic organisms (disease forming) whose presence is not discernible by the eye.

An important feature that is often overlooked when locating a plant near a source of good natural water is the variation in its composition. Many rivers vary as much as 100 per cent from week to week. Floods, heavy rains, melting snow or a discharge from some factory upstream may cause the widest change in quality of the water and throw out all calculations.

The Impurity Known as "Hardness"

Hardness is the chief issue in the water problem as applied to the laundering and textile industry.

As we learned in the discussion on alkalies, there is a group of metals known as alkali metals. Among these are calcium, magnesium, sodium and potassium. All of these metals readily combine with other substances to form compounds. Some of the compounds formed are soluble—others insoluble. When a water contains the soluble compounds of calcium and magnesium, it is said to be "hard," and the process known as "water softening" is designed to effect an exchange of substances composing the compounds so that the calcium and magnesium compounds will exist as "insoluble" rather than "soluble." The insoluble compounds are far less troublesome than the soluble, and can be controlled.

Compounds That Cause Water to Be Hard

When present as a bicarbonate the hardness is termed "temporary," and when combined as sulphates or chlorides the hardness is termed "permanent." All of these soluble forms of hardness react with detergents. Until this reaction "satisfies" the hardness, little or no detergent action can take place, because the hardness has so great an affinity or attraction for certain alkali compounds. The reaction between soap and hardness is in reality a water-softening operation. No laundry owner can afford to let it take place freely, however, because the substance formed is a sticky, insoluble compound, variously called calcium soap, lime soap, soap curd, etc.

The laundry owner has many evils to guard against in his efforts to produce white, sweet-smelling laundry, none of which relates to lime soap. But, on the other hand, all of them put together could hardly be responsible for as much trouble as lime soap causes in a washroom where scientific steps are not being taken to counteract it.

Calcium and magnesium are similar in their reaction effects, though it is to be noted that magnesium compounds consume more soap than the same amount of calcium.

The following is a chart of the usual types of hardness compounds:

CALCIUM

Temporary hardness: Bicarbonate. *Permanent hardness:* Sulphate or chloride.

MAGNESIUM

Temporary hardness: Bicarbonate. *Permanent hardness:* Sulphate or chloride.

Impurities Other Than Hardness

There are several other undesirable conditions associated with hard water. Among the contaminations frequently encountered are: (1) Iron; (2) sulphides (sulphur water); (3) salt (sea water); (4) suspended matter.

In some cases iron causes more trouble than hardness, and it is often overlooked in analyses as a possible source of trouble. Iron is not removed by zeolite softeners, and is often found in water considered "soft" and suitable for laundry use. Most of the iron contamination is due to corrosion in pipe lines, and in cities where chlorine gas is employed as a sterilizing agent corrosion is usually excessive. The safest procedure is to anticipate the formation of stains by proper souring.

Sulphur as an Impurity of Water

Sulphur water is a source of considerable annoyance to those who are obliged to use it in the washing process. The sulphur is present as hydrogen sulphide gas or solid sulphides. It interferes with the proper action of the

soap and promotes the formation of intense stains, especially from traces of iron.

One of the best remedies seems to be the use of an oxidizing agent, such as bleach, in every operation prior to souring and rinsing. Just enough soft bleach should be used to insure persistence of a slight odor of chlorine throughout the bath. A small amount of Escolite should be used also. This applies particularly to the break where materials are not always used.

The bleach is employed to convert the sulphide into a harmless sulphate. A slight excess of bleach is necessary and the bath must be alkaline. Otherwise a separation of free sulphur and formation of sulphuric acid may occur. The bleach is practically all consumed in destroying the sulphide and no destructive bleaching action should result. The sodium silico fluoride sours or acetic acid are recommended in the sour bath, and the temperature should not be forced above 140 deg. Fahr.

Salt Water (Sea Water)

In this case the water contains considerable common salt as well as the ordinary calcium and magnesium compounds. The average analysis of ocean water indicates the presence of about 3.5 per cent salts and 96.5 per cent water. The dried residue obtained from the evaporation of ocean water has approximately the following composition: Salt, 77.76 per cent; magnesium chloride, 10.88; magnesium sulphate, 4.74; calcium sulphate, 3.60; potassium sulphate, 2.46; calcium carbonate, 0.34, and magnesium bromide, 0.22 per cent.

Although salt does not combine with soap, it tends to throw the soap out of solution, which fact is utilized in soap manufacture. Soap is a cleansing agent by virtue of its colloidal properties; and a salt solution, being the exact opposite, seriously hampers the progress of colloidal action. Visible evidence of this is shown in the difficulty to produce or maintain a suds in salty water.

The destructive influence of salt on soap is usually overcome by increasing the washing and rinsing temperature, and also by using an excess of soap and alkali over and above the destructive capacity of the salt present. Naturally the result is an abnormal consumption of detergents to do a given amount of work. Cocoanut oil or palm kernel oil soaps are better in salt water than the tallow soaps, but the former must be used at lower temperatures.

The use of colloidal alkali also relieves the situation, because its colloidal content increases the ratio of colloid against non-colloid in the solution without overloading the bath with soap. The practice of using a large quantity of soap creates a rinsing problem which is further opposed by the salty water used in rinsing.

Salt water cannot be softened in the zeolite softeners, as the salt in combination with the lime and magnesium compounds would have the effect of making the zeolite work both ways at once; which, of course, it cannot do. The resulting balance between softening and rejuvenation would be dependent upon the ratio of salt to hardening minerals in the water. Under the best of conditions salt-water washing is not very economical or satisfactory.

Occasionally a water supply is contaminated with suspended matter in the form of clay slimes or decomposed organic matter from swamp drainage. These cases require special treatment to throw down the colloidally suspended impurities and the separated material filtered off.

Natural Alkalinity of Water

In the West and Southwest, waters having a high natural alkalinity due to sodium carbonate and bicarbonate are frequently found. The final rinse with water of this character leaves the goods alkaline, and tendering is induced under the influence of heat and pressure of ironing. Correction of this condition by souring with acetic acid in the last rinse, just sufficient to insure an acid reaction of the goods, is recommended.

Where exhaust steam is employed in water heater systems, care should be employed to prevent contamination of the water supply by lubricating oil which is bound to escape removal to some extent at least at the separator. Here is another case where the launderer should be willing to pay slightly more and obtain a special oil which will eliminate the source of trouble, saving him money in the end.

Temporary Hardness

Temporary hardness consists of calcium and magnesium compounds in the form of bicarbonates, as $Ca(HCO_3)_2$.

All bicarbonate compounds are unstable; that is, they decompose or break apart with comparative ease. Heat converts the calcium bicarbonate to calcium carbonate, driving off carbon dioxide gas. The reaction taking place is as follows:

Calcium bicarbonate (soluble; cannot be seen) + heat = calcium carbonate (a white insoluble substance) + carbon dioxide gas + water.

This reaction is exactly the same as the one which takes place when the laundry owner washes with sodas, the bicarbonate of soda being reduced to carbonate of soda, the technical name for soda ash.

The calcium carbonate (or magnesium carbonate, as the case may be) formed by the action of the heat is insoluble. It does not react with soap, because it is an inert substance showing no chemical affinity for detergents. When water containing temporay hardness is boiled, this insoluble lime carbonate is seen suspended as a white substance, settling out gradually.

As a rule, temporary hardness is not as troublesome in the laundering process as a permanent hardness, because the heat of the washing solutions converts much of it into

(*Continued on page* 528)

AMERICAN
DYESTUFF REPORTER

Devoted to the use and application of dyestuffs and the mechanical equipment incidental thereto.

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THE JAPANESE DYE EMBARGO

DURING and after the war, when many countries turned their attention to their dye-producing units each seemed to feel that here was an industry it must protect from foreign invasion, and forthwith put into effect a tariff, embargo or licensing system. This situation, so far as the major dye-producing countries are concerned, has been more or less *in statu quo* during the past year or so, but the recently announced determination of Japan to enforce a strict embargo on certain imported colors gives rise to the thought that eventually all manufacturing nations may become largely self-sufficient so far as a supply of dyestuffs is concerned. Of course, such a condition could come about only in those countries which are at present endeavoring to develop their chemical industries.

The German industry, it is quite needless to point out, supplies the entire requirements of German dyestuff consumers. The Swiss industry is no less capable of caring for its small home demands. The British dye industry now produces 80 per cent of England's requirements and is dependent for very few of its crudes upon foreign supply. The Italian industry, favored with a similar independence as regards intermediates, also produces a substantial proportion of its requirements.

And now Japan is determined that her struggling infant dye industry shall have the support it needs to combat the steady importation of overpopular foreign products. It appears that Japan's industry has been battling rather heroically against annihilation, owing to the widely current notion, also prevalent in America, that foreign dyes are superior to colors produced at home. One Japanese newspaper even supports this belief in a statement which says in effect that the quality of foreign dyestuffs more than compensates for their higher price, an argument which German, British or American dye firms would naturally not attempt to dispute.

But the Japanese Government, ignoring the element of quality and fearing only for the life of its industry, is firm in its intention to enforce an embargo on foreign dyes, declaring that domestic makers can produce three-quarters of domestic requirements. The dyestuffs which will come under this ordinance are those which Japan can produce in sufficient quantities to supply her own demand. Sulphur Black is the principal color in this class. The importation of synthetic indigo also will probably be restricted. With the exception of these colors and a few others, the manufacture of dyestuffs in Japan is as yet in an undeveloped state.

When this embargo goes into effect American manufacturers may lose a small portion of their foreign trade. But those who are inclined to resent this sudden exclusion of our dyes from Japan's markets should not fail to look at the embargo from the Japanese point of view. They should consider the motive behind the action; for were we not once spurred on in our fight for protection by that same motive? We should assume a sympathetic attitude when viewing the present situation in Japan, for we ourselves passed through a similar period where only hearty governmental cooperation saved our industry from annihilation.

But, after all, the embargo is likely to do small permanent harm to our dye-export trade with Japan. Certain American colors, like German, Swiss and British colors, will probably always be popular with the Japanese textile trade, just as certain foreign specialties will in all probability continue indefinitely to be imported by our own textile manufacturers. The Japanese embargo merely indicates a serious and creditable attempt by a foreign country to protect an industry which is more and more assuming a position of importance in the industrial systems of the world's largest nations.

SIMPLIFYING THE TARIFF

IN January of this year representatives of importers and dye manufacturers conferred with Assistant Secretary of the Treasury Moss and other Government officials regarding modifications of dye customs regulations desired by the importers. During the discussion the importers brought up for attention three principal points. One of these was a request that appraising officers give information as to the United States value of non-competitive colors as well as competitive colors. The importers have won their point; this request has now been granted. The regulations covering importation of coal-tar products have been amended to make it possible for importers to get advice from customs officials on the value at which non-competitive dyes should be entered. In the future the importer will have a clearer knowledge of dye prices and values, and can avoid penalties for innocent undervaluation. Although the source of the price information is not permitted to be disclosed, the infor-

mation will be none the less useful to those obtaining it.

This amendment will act as oil on the intricacies of tariff machinery. Though it is but a minor change in former procedure, it is a definite sign that the customs department earnestly desires to perfect at every opportunity the present system of levying duty on dyes. Trouble, disputes and litigation they evidently want to avoid so far as is compatible with standards of tariff regulation. By conceding to requests for information from parties interested and desirous of doing the right thing they simplify the tariff system and throw light on puzzling particulars which promote misunderstanding and delay.

T. C.'S COLUMN

THE "T. C." AN EXECUTIVE

THE success of the textile chemist depends on a great many things, the first of which is being in the right place at the right time. Then, he must know his job, or at least be able quickly to see through the established processes and understand whatever in the way of chemical knowledge may apply to them. We have attempted in previous issues to show how a deeper knowledge of theoretical or physical chemistry will be of great value to him in any capacity, and how a reasonable amount of general knowledge of electrical and mechanical appliances will be of special value if he has the ambition to go forth into the plant to seek his fortune. Work in the laboratory or outside of it depends also very much for its success on personal qualities and personal contacts, and especially on relations with people outside of the laboratory circle.

A man in the mill cannot work alone and accomplish anything, except in very rare instances. Nobody knows it all so thoroughly that he does not need help from his co-workers who have specialized on many of the details; and with rare exceptions nobody can earn a very large salary through his own unaided efforts, for unless he is a genius at invention he simply cannot do work enough. The result is that to accomplish much of anything you have to work with other people or direct the work of other people.

The term "executive" has always had a formidable sound, and executive ability has always seemed like something that one could not practise unless he had a hundred or so men under him and a number of balls of red tape. As a matter of fact, any man who has even a desk or uses a part of a bench as his own can display executive ability in keeping it clear and in systematizing his work. Getting the habit of keeping the desk clear so that each night each item of work is either definitely completed or taken care of in some way so that it will appear again on time, and not get shoved into some heap of papers and be forgotten, is a step toward acquiring executive ability. Systems of notes, ticklers and reminders of various sorts for personal use are one of the tools. Keeping yourself on the job, with or without such aid, is more creditable than prodding the other fellow and nowhere nearly as easy, and keeping oneself efficiently busy is the best training in knowing when the other fellow is busy.

Executive ability is not easy to define, but it appears to be the ability to get the best—not necessarily the most—work out of people, including yourself. The most efficient executives seem not to be the ones who sit around telling the rest what to do but the men who set the pace.

As soon as contacts are established outside the laboratory human problems immediately arise, and it is frequently a puzzle how to get along with this one or that one; and while nobody can give general advice on how to get along with folks, there is no other principle better than the only tool we can think of at the moment that will never wear out—the "Golden Rule." It certainly does seem to be wasted on some people; but unless you are quite sure of conditions it is better to try it out, perhaps cautiously at first. In automobile driving none of us would have any trouble if it were not for the other fellow; *we* can drive all right, but we can never tell what he is going to do. However, so far as *he* is concerned we also are the other fellow and, whether it is autos or chemistry, there are usually two sides wherever there is an issue. The chemist frequently represents a new order of things, so the burden of proof is on him, a fact that should never be forgotten.

Closely related to executive ability is the subject of records. It is of great importance and may mean much to the individual or to the firm. You will find differences of opinion, and will be given different advice by different people, according to their own ideas or experience; but, in general, secretiveness gets you nowhere, and it is far better to have good complete records covering all phases of your work than to take a chance on not having them. *You* can be replaced if there is need, whether you have your work in good shape or not, but the advantages of leaving it in an orderly manner are obvious if you are suddenly called away on a long business trip, given an opportunity for promotion in your own organization or a better chance for advancement outside. In other words, there are the best of business reasons for having clear and complete records and, if possible, a trained understudy.

The sincere worker who desires to get ahead on his merits usually finds it difficult to form a most valuable habit, one that is not practised enough—the habit of self-analysis. Some men rate themselves far higher than anyone else would, but never seem to be able to prove up to the value set. Others, conscious of their

deficiencies, but more often through lack of experience than of ability, underrate themselves. The happy medium of true valuation includes present worth and something for future prospects. You cannot necessarily cash in on the prospects when asking for a salary, but do not overlook them when considering a job that may look a little too big. Growth comes only from working on things that are a little beyond us, not from doing over and over those with which we are already perfectly familiar. T. C.

INQUIRY DEPARTMENT

All classes of chemical work or advice relating to artificial colors, natural dyestuffs, dyewoods, raw materials, extracts, intermediates, crudes, or dyeing chemicals and accessories in general, will be carried out for readers and subscribers of the AMERICAN DYESTUFF REPORTER by this department.

Inquiries of a minor character will be answered on this page, while major matters involving personal investigation, analyses, perfected processes and working formulas, will, if desired, be treated confidentially through the mails. In answering inquiries which, by their nature, require reference to the products, processes or apparatus of some particular manufacturer we aim to be absolutely impartial. We refer the inquiries to specialists whom we believe to be best qualified to answer them intelligently, and must disclaim responsibility if their reports show unintentional bias. All questions, materials for analysis or letters leading to the opening of negotiations for special work will receive prompt attention if addressed to Inquiry Department, American Dyestuff Reporter, 90 William Street, New York City.

A. L. F.—Question: In scouring woolens previous to dyeing, the goods get full of small waxy specks and often dye cloudy. Can you tell me how to correct this?

Answer: The trouble you mention is a common one and is due to the formation of lime soap. Lime soap will form most readily with hard water and soaps made from tallow or olive oil. There is less chance of trouble with palm or cocoanut oil soaps, and in every case it is advisable to add some phosphate of soda to the water before putting in the soap. Soda ash also helps but it is better not to use too much on account of the feel of the goods. When the goods have been completely scoured they should be rinsed hot until most of the soap is removed, because cold water will cause any of the lime soap that may be in suspension, to collect together in small masses and stick to the goods. Of course, all troubles of this sort are banished forever by the installation of a system that will remove the hardness from the water.

W. S. Co.—Question: Can you tell me the name of a dye or coloring matter that will color oils and waxes and be fast to caustic soda and light?

Answer: The material you refer to is probably chlorophyll, the green coloring matter of plants. It is soluble in alcohol, ether and oils, and is unchanged by strong alkalies.

M. & Co.—Question: What dyestuffs may be used in the coloring of rubber before vulcanizing?

Answer: This question has been thoroughly gone into by the rubber industry, and at present they are only able to use the insoluble azo lakes and vat dyes, which are practically pigments when so used. However, a surface coating of color may be made on the vulcanized rubber by means of oil soluble and spirit soluble dyes dissolved in benzol and alcohol.

E. L. W.—Question: What is the cause of brownish spots and clouds on cotton goods bleached with chlorine gas?

Answer: Such spots were formerly of common occurrence and are generally due to the exposure to the air of cotton material containing caustic soda. There is no danger of this happening when a closed kier is used as the caustic may be entirely washed out before air is admitted. The stain is due to the reoxidation of a coloring matter that had been extracted from the cotton and which appears to be resistant to chlorine. The other possibility is iron stains, which are easily recognizable.

The Newport Chemical Works, Inc., have issued another insert for the binder which this company recently distributed and which contained three useful technical bulletins. The new insert is a leaflet describing the uses of Isomerpin, an entirely new product in the class of hydrogenated hydrocarbons which has been put on the market in anhydrous form. It combines the effects of a wetting-out agent with those of a high boiling, fat dissolving agent with special dissolving capacity for all kinds of unsaponifiable fats, mineral oils, wax, paraffin, etc. The leaflet tells of its use for wetting out and gives some idea of its merits in this respect.

THE SINGEING OF COTTON FABRICS

(*Continued from page* 512)

to a gas and air mixing system, a high-pressure gas system or a positive pressure air-gas system. The use is recommended of the positive pressure air-gas system for which can be furnished positive pressure blowers.

The positive pressure air-gas system lends itself most excellently to automatic temperature control. This automatic temperature control apparatus maintains the desired temperature—in this instance the temperature of the singeing cylinder—automatically within five degrees, plus or minus, of the desired point.

Many hundreds of these temperature control apparatuses are in general and satisfactory use, not only in the United States but also in all other industrial countries of the world.

The production of singeing equipment depends largely on the efficiency of the apparatus as well as the class of merchandise to be processed, and the speed of the moving cloth should be varied to suit the weight and denseness of the fabric.

On some of the heavier fabrics 100 to 150 yards per minute would be classed as quick production, while on sheer fabrics a production of from 250 to 300 yards per minute should readily be attained.

Slight contact of the cloth with the singeing cylinder, extreme heating capacity, high heat resistance of the nichrome cylinder, a continuously freshly heated surface, freedom from oxidation, perfect combustion of gas fuel, economy of gas consumption, simplicity of operation and the fact that maintenance costs are minimized result in the highest possible efficiency of operation and production.

Practical Hints on the Production of Bright Colors on Textile Fabrics

Part V

Dyeing Balled Cloth Ropes—Coloring of Balled Material—A Perfected Plant—Method of Operation—Dyeing Chains of Cotton Cloth—Dyeing During Submersion—Operation of Plant Used

By RAFFAELE SANSONE

FOR dyeing balled cloth ropes, a series of plants are at present in use and are giving very good results. One of these is constructed on the principle shown in Fig. 5.

This consists of three strong hardwood tubs (A, B and C), the first of which (A) serves for the preparation of the dye baths, while the other two, B and C, are employed for the dyeing operations.

Tub A has on its bottom a closed or open steam coil for the preparation and heating of the different dyebaths, and a discharge hole, closed or opened from above and leading into a lower collection cistern placed just before the plant in the flooring of the works and covered over by wooden planking. It has at its back a tube leading to a centrifugal pump, not to be seen in the illustration, and worked by a fixed and loose pulley (P). The above coil is supplied with steam from without by tap J.

Tubs B and C are placed at a certain height on low wooden frames, of which only two are to be seen in the figure, where they are indicated by M and N. They are of strong construction and supplied inside with a double perforated bottom of wood or copper. Below this bottom is a large tube and tap leading to an independent centrifugal pump which has an upper tube leading to the top of tub A and serving for the circulation of the dye baths. The tubs B and C are sometimes supplied with a wooden cover having a hole of just sufficient size to allow the passage of the dye bath coming down from tube T.

Work on the Plant

The work on the above plant comprises three different operations: the preparation of the dyeing liquors, the coloring of the balled material, and the rinsing.

The preparation of the coloring matter baths does not differ very much from the usual methods adopted on other machines. For the purpose tub A is filled to a certain depth with water and warmed to the boil by the closed or open steam coil placed at the bottom of the tub. Add the weighted quantities of the different dyestuffs, stir the bath with a wooden stick from ten to fifteen minutes, and add a small quantity of carbonate of soda, if the nature of the water requires it and if the colors can stand the addition. When in this way everything has been mixed, the quantity of liquor in tub A is increased with more water and before the bath begins to boil again it is used for the dyeing operations.

Coloring of Balled Material

So as to guarantee a uniform treatment of the material, it is placed in a tightly packed condition, either in tub B or in tub C, on the perforated wooden or copper double bottom already indicated, so that free passages cannot be formed between each ball of cotton cloth, the balls being left as elastic as possible.

Layer above layer of the balls of cloth are thus arranged until they are stacked to within a few inches of the top of tub B or C. When this has been accomplished, the dye bath, which has been prepared in tub A, as already mentioned, is caused to fall by tube T, by means of the centrifugal pump at the back of tub A, onto the material in tub B or C.

When in this way the material has been properly soaked, the tap at the bottom of tub B or C is opened to let the pump take up the dye bath collecting below the perforated double bottom and deliver it into tub A to be utilized again with the dye bath still present therein.

In this way the material is gradually colored to the required degree and the treatment can be stopped after a time, withdrawing all the dye bath into tub A and causing the pump below tub B or C to spray clean running water through the material for some time, delivering this water to the waste water main through a special tap, after having closed that on the tube leading to tub A.

While this work is being accomplished in one of the tubs, the other is filled with another lot of balled chains of cloth, and as soon as all the dye bath has been drained from the batch just dyed the contents of tub A are emptied out and replaced by a fresh dye bath, unless it can be employed again, or after additions of fresh coloring matter the dyeing operations are proceeded with as in the first case.

When the rinsing operations are completed, the dyers stop the entrance of the water and allow the pump to work until no further bath can be extracted. At this point they withdraw the material by hand, placing it on trucks and leading it to the cages of hydro extractors, where all excess of water is eliminated. The warps can be brought to the drying department to be treated there as may be most convenient, either in drawer drying machine or by other means.

A Perfected Plant

The above plant, although giving very valuable results in the dyeing of balls of cotton cloth, possesses, however, the serious inconvenience of requiring many operators, rather large quantities of dye bath, a large occupation of floor space for the low production obtained and a large employment of pumping machinery and, consequently, of motive power; and its use involves the danger of producing irregular shades, especially with balls of thick cotton cloth.

For avoiding many of the above inconveniences, a plant was introduced some time ago constructed on the principle shown in Fig. 6, which allows the dyeing of the material under a certain pressure, permitting, when required, the boiling out of the cotton material.

This shows a cylindrical copper-plated iron boiler (B) fixed on four iron legs at a certain height from the ground and strongly imbedded in the flooring of the works. The upper portion of boiler B is closed with a heavy copper-plated iron cover (C), hinged at one side and clamped at the other, which closes hermetically, preventing any loss of steam or heat.

Below this boiler is placed a large copper tube (T) ending in the centrifugal pump P, which serves for the circulation of the treating liquids on the plant and

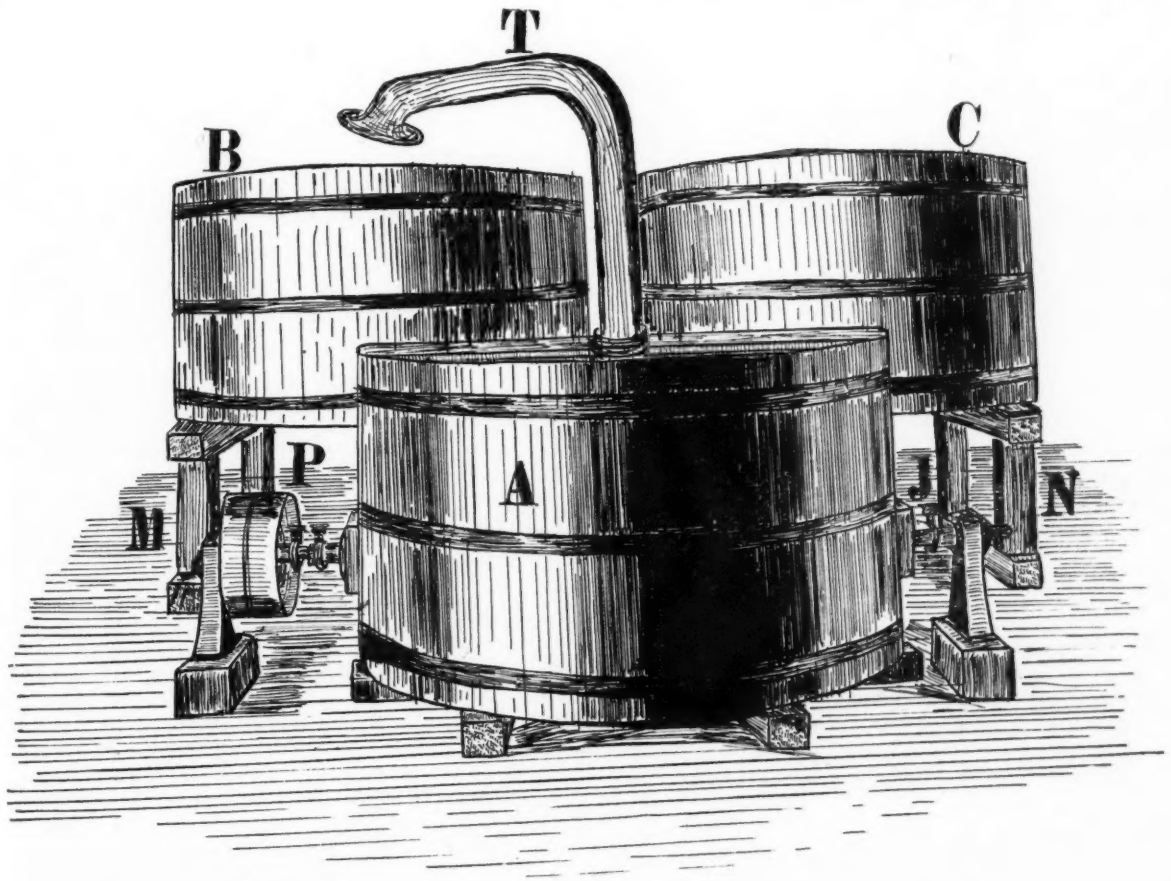

Fig. 5

delivers all dye liquor to a heater (H) through tube K, warmed by steam entering through tube L and escaping by tube O. From the heater the dye bath is run by tap Z to a large tube at the bottom of the plant (G), being led to the upper portion of boiler B. The interior of this boiler contains a perforated double bottom, a pressure gauge, etc.

Method of Operation

The work on the above plant would be as follows: The operators, after having freed the interior of boiler B from all traces of preceding dyeing operations, enter the balls of cotton cloth in the boiler, placing them on its double bottom until they come to within 4 to 5 inches below cover C. When this has been accomplished, they close down the cover and prepare the dye bath in a separate vat at the back of the plant, entering it, through a tap connected with pump P, into the heater H till this is filled, and then running it into the interior of boiler B by tube G.

When in this way sufficient dye liquor is prepared for the treatment of the material, its entrance is stopped by closing the tap and opening another tap on tube T to allow the pump P to force the bath in boiler B to pass repeatedly through the heater H and through the material in boiler B.

After a time the steam produced in boiler B creates a certain pressure, controlled through the assistance of a pressure gauge, which greatly assists the dyeing operations. The dyeing is continued for a fixed period of time, depending on the depth of shade produced, nature of colors used and process adopted. After the dyeing the dye bath is run off into a collection cistern or into the waste-water main, and cold water is made to circulate through the material in boiler B till it makes its exit quite free from coloring matter.

Dyeing Series of Chains

Series of chains of cotton cloth are dyed to advan-

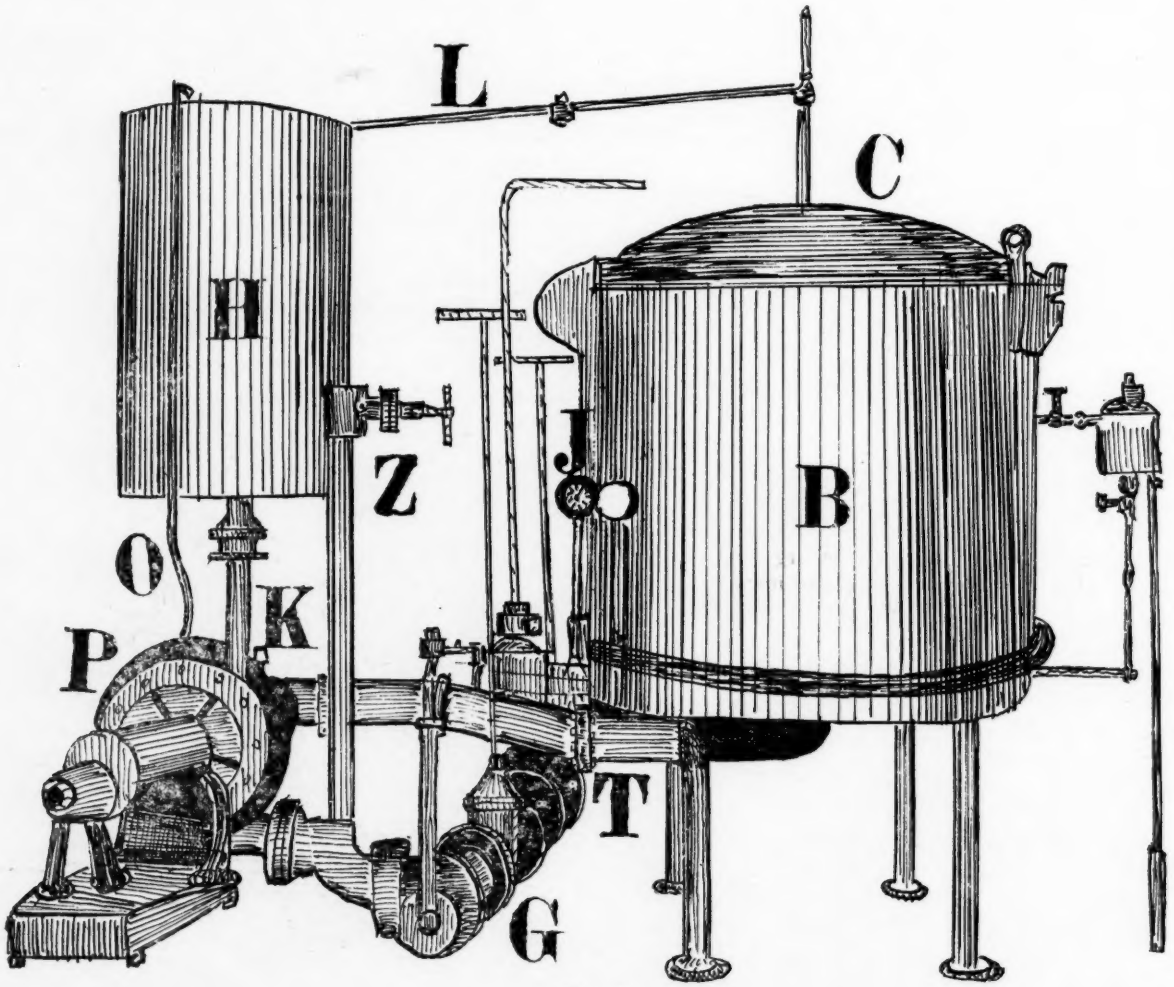

Fig. 6

tage in some plants; in this way a large production is possible at small cost. Some care, however, is necessary in the choice of the plants, as some machines offer more advantage than others. A type of installation in use in some works for the dyeing of bright colors in soap baths, and one which can treat two chains of cotton cloth in one run, is shown in Fig. 7.

This contains a large rectangular wooden vat V, enclosing a copper or copper-plated iron vat (C) with a sloping bottom so that all bath can run through a large tap leading to an internal discharge channel (D). Above vat V is placed a solid double iron frame (F and G), sustaining the squeezing cylinders A and B, which receive two lots of warps (M, M and N, N), guided between them and lower guiding rollers in vat C by a series of wooden pegs (S) fixed in a long wooden beam. The pressure on the pressing cylinders (A and B) is given by screws P and R and light levers and weights.

The squeeze cylinders A and B are driven by a large iron pulley (O), which can be stopped or set in motion by moving hand levers (L), and is worked from an overhead transmission by a belt. By the use of a friction clutch at the end of the bowl B, pulley O can be employed, doing away with the use of a loose pulley for stopping and starting the machine.

To introduce water for dissolving or rinsing purposes in vat C, there is a large tap before the lower squeezing roller B, indicated in the sketch by T, while all heating operations are conducted with a closed steam coil placed in vat C below the lowest guiding rollers for the cloth bands.

Operation of Plant

The working of this plant would not be very complicated. The operators after having cleaned thoroughly the squeezing cylinders A and B and the dyeing trough C, allowing plenty of clean running water to pour over them, close the discharge cock below vat C and adjust the squeeze rollers to introduce the two separate lots of chains of cotton cloth, joining the ends of these latter.

They then enter the dye bath in vat C, turning on steam in the coil therein, and start the machine. The different spirals of cloth run continually in the dye bath, and between the squeezing rollers A and B, gradually dyeing the material in the desired shade. While the machine is still moving they run off the dye bath and follow this by a rising water entered by tap T.

The above plant offers special advantages for the dyeing and rinsing of heavy goods, particularly because the pressure bowls A and B can be taken out for changing or cleaning. The diagonal arrangement of the bowls increases the efficiency of the treatment.

Dyeing During Submersion

When it is required to dye ropes of cotton cloth during submersion, a plant is employed constructed on the principle indicated in Fig. 8.

This shows a large dye tub (A) divided into two equal parts (C and D), in which the warps are submerged during their progress through the plant. Dye tub A is followed by a long vat subdivided into three compartments (E, F, G), where the material is rinsed after the dyeing and, if necessary, soaped or otherwise treated. Dye vat A is surmounted by a small pair of squeeze rollers (S), for use in entering the warps after their passage through a guide which keeps them at a regulated distance from one another and has at its end a much larger pair of pressing rollers (T), used for freeing the chains of cotton cloth of all excess of liquid after their exit from the dye bath and before their entrance in the second compartment D.

Before entering this second vat, the material is passed through a second pair of squeeze rollers (U), supplied with channels for holding the separated warps in position. Both compartments C and D are supplied with a perforated double bottom, below which is a closed steam-heating coil. On leaving compartment D the chains of cotton cloth pass through a second guide with holes at regulated intervals, and enter the squeeze cylinders indicated by 1 before passing into the first compartment (E) of the rinsing vat B, an upper roller leading down into the vat.

The two compartments of the dye vat (C and D) are supplied with a certain number of perforated copper plates (generally from six to ten) placed apart from one another; these prevent the touching of the different warps passing through the machine. The

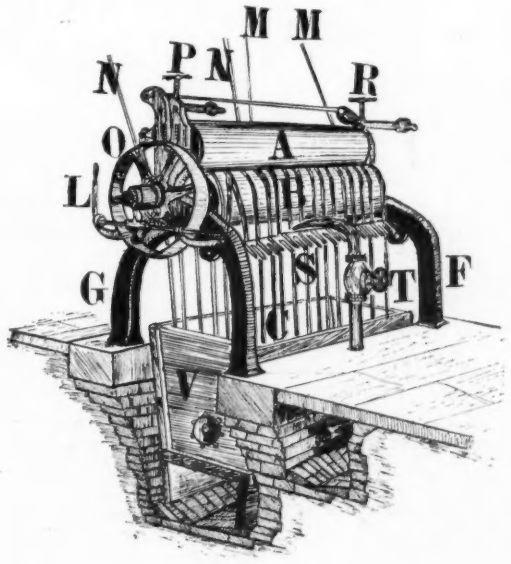

Fig. 7

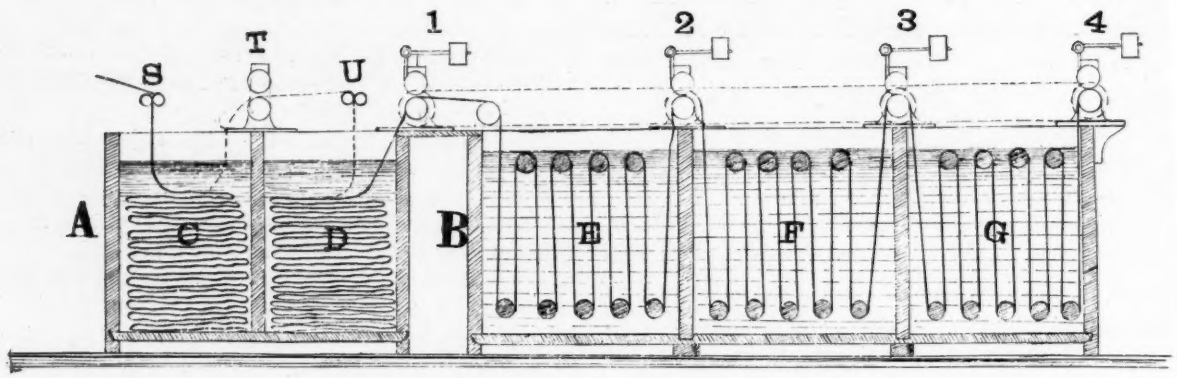

FIG. 8

three compartments of vat B are more or less of the same size and contain a certain number of upper and lower guiding rollers. Above these are three pairs of squeeze rollers (2, 3 and 4).

OPERATING THE PLANT

Work on the above plant would not be very complicated. The operators enter in the first compartment (C) a certain length of the series of warps to be dyed, after having run off the last cleansing water; the ends of these warps are joined to the corresponding number of tapes which pass through all the following compartments and between the nip of the squeeze rollers T, U, 1, 2, 3 and 4. When the above operation has been accomplished, they enter all dye baths in compartments C, D, E, F and G and start the squeeze rollers of compartments C and D. In this way the warps are run into the second empty compartment D, taking up what coloring matter they could not absorb in compartment C and filling this up to a certain height, at which point the machine is started to effect the passage of the warps out of vat A and so into and through compartments E, F and G for the rinsing operations. From the start the dye baths in C and D are kept at the required temperature by a steam coil at the bottom. As vat A, and later the whole plant, is worked, fresh cloth makes its way into compartment C, remaining there a longer time than was possible at the beginning of the work, thus compensating for the shorter time that it remains later in compartment D.

(To be continued.)

Officials of the air service branch of the War Department state that a large quantity of airplane and balloon cloth has been delivered to the Fall River Bleachery for finishing. The cloth, which was shipped from Government surplus stocks, consists of 102,750 yards of 4½-ounce A. A. cloth and 9,550 yards of 4½-ounce B. B. cloth.

SCIENTIFIC WASHING

(Contnued from page 520)

the harmless carbonate. On the other hand, the earlier operations of the wash (break) frequently have insufficient heat to cause the proper decomposition of temporary hardness. The result is that considerable lime soap may form.

PERMANENT HARDNESS

Permanent hardness is so called because it is stable under ordinary conditions. It cannot be reduced or neutralized by heating. This hardness consists chiefly of calcium and magnesium sulphates and chlorides.

When we add certain alkaline substances to water containing permanent hardness, a chemical change takes place and the hardness is separated from the solution as insoluble compounds. If the water is standing in a tank the precipitate will settle to the bottom, whence it can be discharged or the clear softened water drawn off from above. The methods of removing hardness are discussed more fully later on.

HOW HARD WATER WASTES SOAP

The method best adapted to softening the water in any individual plant depends largely upon the form of hardness and its amount.

The argument usually advanced to justify the installation of a water softener is based upon the saving of detergents. As a rule, the cost of softening water is less than that of the extra detergents required to overcome the hardness in the washing machine. The reader will appreciate this better when he realizes that one degree of hardness destroys approximately 1.7 pounds of soap per 1,000 gallons.

The following table has been prepared to show what this means for waters of varying degrees of hardness:

Cost of Destroyed Soap (at 10 Cents per Pound) Per 1,000 Gallons of Water

Hardness	Soap Destroyed	Cost
5 degrees	8.5 pounds	$0.85
10 degrees	17.0 pounds	1.70
15 degrees	25.5 pounds	2.55
20 degrees	34.0 pounds	3.40
25 degrees	42.5 pounds	4.25
30 degrees	51.0 pounds	5.10
35 degrees	59.5 pounds	5.95
40 degrees	68.0 pounds	6.80

Although the item of cost is important, a factor of greater weight in favor of water-softening apparatus is the elimination of gray work and "grease" specks. These are caused by the absorption of insoluble lime and magnesium soap in the goods. The familiar transparent spot which often appears on restaurant linen is an example of lime soap. Moreover, in rinsing, the heat has a tendency to decompose the particles of lime soap, setting free the fatty acid which is a direct source of grease specks and grayness.

The answer to the question, "to what degree of softness is it desirable to treat the water?" depends upon the use to which it will be put. If it is a laundry owner who is asking the question he must in turn ask himself, "Am I ready to provide ideal conditions for the handling of my customer's work, placing any consideration of cost second in my thought?" A laundry owner never will regret taking a step that improves his work.

There is no doubt but, for washing purposes only, water is best when at the point of zero hardness. As to the direct return on the investment through detergents which are saved, this will depend upon the market price of soap and the amount of hardness in the natural water. The consideration of improved *quality* should outweigh the consideration of cost—as it should in every other operation in the laundry. No other policy can bring the industry its rightful share of patronage.

The following may help the reader to understand what takes place in softening water:

The soluble compound calcium chloride (causing "hardness" in water) exchanges base with another soluble compound, sodium carbonate (containing softening properties), and forms the new insoluble compound calcium carbonate.

Calcium sulphate exchanges base with trisodium phosphate and forms calcium phosphate.

Magnesium chloride exchanges base with sodium zeolite and forms magnesium zeolite.

Magnesium sulphate exchanges base with sodium stearate (soap) and forms magnesium stearate.

Calcium bicarbonate exchanges base with sodium hydroxide and forms calcium carbonate.

The Action of Acids on Cotton

Weak and Strong Acids—Cellulose Converted into Alcohol—Technical Uses of Strong Acid—Wool Effects in Cotton—Tendering in Acid at 100 Deg. Cent.—Tendering at 60 Deg. Cent.—The Action of Acids

By A. J. HALL

ALTHOUGH it is fortunate for everyone that no one can control the weather, most dyers and bleachers would agree, that had Nature consulted the textile industry, a cotton having natural properties more adaptable to textile treatment could have been evolved. For instance, for the cleansing of cotton and wool, acids and alkalis are the most useful agents. Yet all textile fibers are found to be easily damaged when treated with one or the other of these substances. Wool is susceptible to alkalis, but more resistant to acids, while cotton is resistant to strong alkalis and easily attacked by acids. An annoying state of things, but one which has to be faced.

Apart from processes involving oxidation, the action of acids on cotton is, therefore, of considerable importance to all cotton bleachers and dyers and even finishers. Yet, although the main facts concerning the susceptibility of cotton to acids have been known for a long time, such knowledge is very imperfect and incomplete. For instance, although every bleacher knows that fabric containing acid must not be dried, if tendering is to be avoided, probably not one bleacher in a hundred knows whether there is any relationship between the degree of acidity and the resulting degree of tendering, whether the action of the acid is purely catalytic or whether the acid enters into chemical combination with the cotton. Such ignorance, though deplorable, is, however, easily excusable, since textile chemists, who have generally more opportunity for investigation, are quite as much in the dark.

Weak and Strong Acids

The fact is, that the action of acidic substances on cellulose or cotton is so complex that its nature has only been partially investigated, and our knowledge concerning it is, therefore, necessarily incomplete.

From time to time, however, various textile workers have studied the behavior of cotton toward mineral and organic acids, the results being both interesting and useful. It is the purpose of this article to review some of these investigations.

In the first place, it will be evident that the chem-

ical reactions involved when cotton is subjected to an acid treatment, will be largely determined by the acid itself. This is particularly the case when a weak acid is employed. With strong acids, however, except in the case of organic acids, the chemical degradation of cotton appears to be less dependent on the acid used. Thus the ultimate result of the action of strong sulphuric acid on cotton is to resolve it into dextrose—a sugar—and the same result may be achieved by means of hydrochloric acid. In neither case does the reacting acid enter into combination with the resulting sugar. When these acids are used in dilute form, there is evidence, however, that sulphuric acid unites with the cotton, while hydrochloric acid does not, although hydrocellulose is the product formed in both instances. But this will be referred to later.

All mineral acids attack cotton comparatively quickly. Girard in 1875, for instance, noticed that when cotton was immersed for twelve hours in cold sulphuric acid of 45 deg. Be. or was heated with 3 per cent sulphuric acid, it formed a product characterized by a very low tensile strength and having low hygroscopic power. Girard analyzed this product, which he termed hydrocellulose, and showed it to have the formula $C_{12}H_{22}O_{11}$, thus differing from the original cotton, $C_6H_{10}O_5$; nowadays, however, hydrocellulose is considered as being so indefinite a compound that little importance is attached to its formula. With strong sulphuric acid, cotton forms esters which are not stable and are easily hydrolyzed by means of water, a degraded cellulose product being thereby formed.

Hydrochloric acid also readily attacks cotton, but there is no evidence to show that it forms any chemical compound with cotton. The usual course is the formation of hydrocellulose and then dextrins and sugars. Willstatter showed that when cotton was immersed in an aqueous solution containing 42 per cent of hydrochloric acid gas, the cotton rapidly dissolved to form a viscous solution, which after dilution and boiling was shown to contain dextrose—the conversion of cotton to dextrose

$$\underset{\text{Cotton}}{(C_6H_{10}O_5)} \quad \xrightarrow[\text{Hce}]{\text{aqueous}} \quad \underset{\text{Dextrose}}{C_6H_{12}O_6}$$

was, in fact, quantitative.

Although the complete degradation of cotton by acid is not often seen in bleaching practice, it is a matter of some importance, as showing something of the nature of cotton, and because of the importance which is now attached to the manufacture of alcohol from cellulosic substances. In fact, at the present time, considerable research is being carried out, having for its object the discovery of an economical method for degrading cellulose into sugar substances capable of fermentation into alcohol.

Cellulose Converted into Alcohol

Thus, when one gram of Swedish filter paper is dissolved 7-8 c.c. of 72 per cent sulphuric acid, and allowed to stand for three hours, complete solution of the paper ensues. After dilution, so that the acid content of the solution is about 3 per cent and digestion of the solution for two hours at 120 deg. Cent., a 0.6 per cent solution of glucose is obtained, and this after neutralization may be fermented for the production of alcohol. Budnikow and Solatarew found that by this method cellulose could be converted into 85 per cent of the theoretical amount of alcohol. This method is the one underlying most of the present processes in which cellulose is completely degraded, but we will now consider the actions of acids on cellulose for the purposes of the textile industry. The treatment of cotton with acids is always for one of two purposes: the acid treatment may be auxiliary, as in bleaching and dyeing, or it may be a means for improving the physical properties of cotton without altering its chemical composition, as in the so-called mercerization of fabrics by means of strong nitric and sulphuric acids. Usually, alteration of the physical properties of cotton, such as luster, is affected by a strong treatment with a cold concentrated acid, whereas in dyeing and bleaching only weak acids are employed.

Technical Uses of Strong Acid

Although the action on strong sulphuric acid on cotton has been known for many years, it is only within recent years that the treatment has been applied to textiles and the conditions of treatment fully investigated. Previously the treatment has found most use in the parchmentization of paper. The various patents taken out, chiefly by the Heberlein Company, Ltd., now show, however, that various desirable effects may be obtained on mercerized and unmercerized cotton fabrics by treating them for a more or less short period in cold sulphuric acid and subsequently removing the acid by washing in water.

For instance, fabric composed of thick cotton yarns may be converted into a linen—like lustrous fabric (English Patent 192,227) by mercerizing it cold (—13 deg. Cent.) and then treating it with sulphuric acid of 50.5 deg. Be. (sp. gr. 1.535) at 5 deg. Cent. for ten seconds and afterward rapidly removing the acid by washing with water. Similarly, a wool-like effect may be produced by mercerizing fabric, then treating it with cold sulphuric acid of 49 to 51 deg. Be., then washing off and mercerizing the resulting fabric without tension.

Transparent effects may also be obtained when the treatment with sulphuric acid is carried out at ordinary temperatures. For instance (English Patent 162,627), cotton fabric is immersed in sulphuric acid of 49 to 50.5 deg. Be. for one to three minutes at ordinary temperature, being stretched at the same time or subsequently. The fabric is then washed under tension, dried, and again treated with sulphuric acid

of 52 to 54 deg. Be. at ordinary temperature for three to five seconds, and then mercerized directly (that is, without previous washing and drying) in caustic soda of 30 to 40 deg. Be. In this manner the fabric is rendered transparent and lustrous.

A difficulty which always occurs in the treatment of cotton by these methods, is that the duration of the treatment must be carefully controlled. In general, the action of the acid is rapid, and particularly so at higher temperatures, so that within a few seconds it is possible to seriously damage the fabric. Hence, efforts have been made to retard the action of the sulphuric acid without impairing its effect, and these efforts have recently met with success. For instance (English Patent 200,881), indicates that sulphuric acid containing formaldehyde acts but slowly on cotton. In the method of treatment here described, cotton fabric, preceded by singeing, is passed through sulphuric acid by 90 to 110 deg. Tw. at 10 to 15 deg. Cent., and which contains ½ to 1 per cent of 40 per cent formaldehyde. It is afterward washed free from acid and calendered or mercerized.

More recently (English Patent 196,298) it has been discovered that the presence of certain heterocyclic bases such as pyridine and quinoline retard the action of sulphuric acid in cotton very considerably. Under suitable conditions, the action may be prolonged fifty times without producing deterioration of the cotton. Thus a soft transparent finish on cotton fabric may be produced by treating it for four minutes at ordinary temperature in a mixture containing one part of pyridine and four parts of sulphuric acid of 66 deg. Be. (sp. gr. 1.86). Similarly, a wool-like effect is obtained by treatment for five minutes with a mixture containing one part of pyridine and nine parts of sulphuric acid of 55.6 deg. Be. (sp. gr. 1.66). These prolonged treatments may be very easily adapted to technical processes.

Wool Effects in Cotton

Finally, a modification of these treatments is described (English Patent 167,864) in which sulphuric acid is partially replaced by nitric acid. By this method wool-like or transparent effects are produced by treating cotton fabric with suitable mixtures of sulphuric and nitric acids at 0 deg. Cent. or under for a period not exceeding one minute. For instance, by treatment at 10 deg. Cent. with an acid mixture containing equal volumes of sulphuric acid of 57 deg. Be. (sp. gr. 1.652) and nitric acid of 41 deg. Be. (sp. gr. 1.397) for ten seconds, a transparent appearance is obtained; by a similar treatment forty seconds with a mixture containing equal volumes of sulphuric acid of 57 deg. Be. (sp. gr. 1.652) and nitric acid of 41 deg. B. (sp. gr. 1.397) for ten seconds, a transparent appearance is obtained; by a similar treatment forty seconds with a mixture containing equal volumes of sulphuric acid of 56.5 deg. Be. (sp. gr. 1.643) and nitric acid of 40 deg. B. (sp. gr. 1.383) a wool-like effect is produced. The slight change in the concentration of acid thus produces a markedly different result.

The action of strong nitric acid on cotton has been very thoroughly investigated mainly on account of its importance in the manufacture of gun cotton and celluloid. More recently, the action of nitric acid as a mercerizing agent has been studied by Budnikoff, with very interesting results. This work is described in the Dyer and Calico Printer, 1924, p. 56, so that it is not intended to repeat them here. It may, however, be pointed out that under suitable treatment, cotton may gain an increased affinity for acid dyestuffs, the fibers may swell and become transparent (similar to ordinary mercerized fabrics), and the strength of the cotton be maintained and even increased.

It is now desired to draw attention to the action of dilute acids on cotton.

Generally, in dilute solution, acids have very little effect on cotton. It would be too much to say that cotton is not affected physically by the action of, say, a 1 per cent cold solution of sulphuric acid, but certainly such action would not produce appreciable tendering. Dilute acids, mineral and organic, have, however, a serious effect when dried in the fabric, particularly at elevated temperatures. Coward, Wood and Barrett have recently published (J. Text. Inst., 1923, 520) some investigations dealing with the subject.

In the first place, these investigators sought a relationship between the strength of acid and the resulting degree of tendering of cotton fabric. For this purpose plain bleached fabric was immersed in acid of definite concentrations, and there maintained for varying periods at different temperatures. Afterward the fabric was washed free from acid in cold water and air dried. The results are tabulated below:

TENDERING IN ACID AT 100 DEG. CENT.

	2 × Normal Acid			Normal Acid		
Period of Immersion in Minutes	1	15	60	1	15	60
	%	%	%	%	%	%
Hydrochloric acid	100	100	100	100	100	100
Sulphuric acid	22	100	100	34	100	100
Hydrofluoric acid	11	100	100	7	28	51
Acetic acid	0	15	15	4	9	18
Monochloracetic acid	3	35	100	17	23	39
Hydrochloric acid × salt	100	100	100	100	100	100

The strength tests of the treated fabrics were determined on 2-inch strips on a Goodbrand machine. Very obvious is the decreased tendering effect of organic acids as compared with mineral acids.

For comparison a further collection of data is given here showing the tendering action of acids on cotton under similar conditions to those employed above, the temperature of the acid liquor being maintained at 60 deg. Cent. instead of 100 deg. Cent. It is evident that tendering is less as the temperature is lower.

TENDERING IN ACID AT 60 DEG. CENT.

	2 × Normal Acid			Normal Acid		
Period of Immersion in Minutes	1	15	60	1	15	60
	%	%	%	%	%	%
Hydrochloric acid	16	45	100	7	25	52
Sulphuric acid	9	16	66	14	18	25
Hydrofluoric acid	0	0	0	0	0	0
Acetic acid	—	2	0	—	0	7
Monochloracetic acid	0	7	12	—	—	0
Hydrochloric acid + salt	5	61	100	0	13	50

It will be remembered that several processes for dyeing aged aniline black without tendering, involve the use of hydrofluoric acid. The employment of this acid is, of course, expensive, but its justification is shown in the foregoing tables.

Coward, Wood and Barrett also observed that when cotton was treated for one hour with sulphuric acid of such low concentration as 0.05 per cent, a measurable amount of tendering occurred.

Further, an experiment in which fabric was treated with normal solutions of various acids at 60 deg. Cent. was carried out in order to measure the relative tendering action of such acids. The results are given below:

THE ACTION OF ACIDS

	Strength of Acid in Normal Solution	Tendering Produced
Hydrochloric acid	0.88	52 per cent
Trichloracetic acid	0.65	36 per cent
Sulphuric acid	0.57	25 per cent
Hydrofluoric acid	0.13	0 per cent
Monochloracetic acid	0.05	7 per cent
Acetic acid	0.006	0 per cent

The values given for the strengths of the various acids in the above table were obtained by measurement of their hydrogen-ion concentrations at ordinary temperatures.

From the table it will be seen that acetic acid has a very small tendering action. This fact finds application in the dyeing of cotton-wool union materials. It is frequently necessary to dye the wool in such fabrics by means of acid wool dyestuffs, and to obtain good exhaustion in the dye bath and also to keep the cotton white or unstained, it is desirable to use as strongly an acid dye bath as possible. It will, therefore, be evident that the most suitable acid to use is acetic acid, since, though not quite so effective as the sulphuric acid, which is ordinarily used, it has a much less tendering action.

Some results of particular interest to bleachers were obtained by drying cotton fabrics impregnated with various strengths of hydrochloric acid. The impregnated fabric contained its own weight of the acid solution, and the drying was carried out between two copper plates electrically heated to 100 to 120 deg. Cent. It was found that fabric containing 0.05 per cent of hydrochloric acid was tendered badly during drying at 100 deg. Cent. for ten minutes; measurable tendering occurred when the drying was carried out for ten minutes at 120 deg. Cent. when the acid concentration was but 0.01 per cent.

It being thus evident that tendering may be produced by very small concentrations of acid, it behooves every bleacher to be very careful to remove "sour" liquors from fabrics after bleaching, and immediately before the fabrics are dried on the "tins." The same care has to be taken by the mercerizer during the after souring and washing. The writer has seen considerable quantities of cloth badly tendered by drying mercerized fabric which has not had acid liquor completely removed from it. In this connection some earlier work by Coward and Wigley is of interest, since they examined suitable methods for determining approximately the acidity of a fabric by spotting it with a solution of an indicator. Their results, tabulated below, are of technical value, since they apply to bleached cotton fabric.

Indicator	Recognizable Acidity	Color of Spot on Fabric
Thymol Blue	0.16% H_2SO_4 and up	Purple
Methyl Orange	0.10-0.16% H_2SO_4	Yellow-red.
Lacmoid	0.06% H_2SO_4 and up	Red
Lacmoid	0.03-0.06% H_2SO_4	Blue center — red ring
Lacmoid	0.02% H_2SO_4 and less	Blue
KI + KIO_3 + starch	0.01% H_2SO_4 and up	Blue, increasing in intensity
Methyl Red	0.005% H_2SO_4 and up	Red

In some later investigations it was found that cotton appeared to preferentially absorb acids from acid solutions. A further interesting observation was that acids were more quickly removed from cotton fabric when washed with a solution of salt in water, than with pure water itself.

It, therefore, appears that fabric cannot be dried with safety unless it contains less than 0.01 per cent. of acid.

In this article there is not space to deal with the action of organic acids on cotton, but it may be pointed out, in conclusion, that it is usual for these to form cellulose esters in the first place, and degradation products of the cellulose subsequently if the action is allowed to be drastic.—The Dyer and Calico Printer.

PONTAMINE BLUE CLG

E. I. du Pont de Nemours & Co. announce the production of Pontamine Blue CLG, representing a product of which the Du Pont company is the first American manufacturer.

This color was widely used before the war, and has the advantage of being able to produce very deep shades of blue without bronzing. It shows a good fastness to alkali and ironing, is easily soluble, and dyes very evenly.

In unions of cotton and wool, or cotton and silk, the animal fibers are left almost unstained at the boil.

The Journal of a Hosiery Dyer

Samples—Buying Supplies—The Daylight Lamp—Whizzers—Nets—Paddle Machines—Oil Finish on Silk Blacks

By S. P. R.

Samples

NOVEMBER 8.—More than half the arguments between dyers and customers have ended in finding that the samples didn't agree. This is more true of silk goods than any other class. When a new color is started the mill generally retains one stocking of a pair and sends the other to the dyehouse, where it is exposed and handled more or less, and in the course of a week or two has taken up dirt, perspiration, grease, or whatever chemicals may be in the air and is decidedly off shade. We adopted a system of having two samples, one for working with and the other kept in a glass jar in a dark closet to check up with. It would surprise anyone to see how much stuff a silk stocking can take up in only a week's time, and, of course, if it is matched exactly the mill is going to say that the color is dull and dark. Even cotton samples should be checked up at regular times and a lot of trouble will be avoided.

Buying Samples

November 14.—If I went in the office to see one-half of the dye salesmen and supply men I wouldn't have a chance to do anything in the dyehouse. Of course, they don't like it if I can't see them and they all imagine I don't want to do business with them. If I tried to test all the things they want me to try we would only be running an experiment station and not a dyehouse. Suppose I have settled on a certain brown for my cordovans because it was good money value and dyes the way I want it to; the very next week there are a half a dozen new browns offered from two to ten cents cheaper, but most likely all a little different in shade and strength. Every salesman feels that I have made the mistake of my life by not buying his color. It has gotten so now that I just leave word in the office for them to mail in a dyed sample of their goods on the right kind of hosiery material, and if it interests us we order a sample lot to use when we need something of the kind. Any color that is working right will not be changed even if we can buy a substitute a little cheaper.

The Daylight Lamp

November 20.—We just received our new daylight lamp and have it working. I never would have believed that anything could be so useful. It is beginning to get dark early and we can go on with our matching till the whistle blows. Even in the day time it is a help when the sun is shining, because across from our window is a red brick building and on the other side a big green sign. When anyone tries to match a gray with those two outside colors shining across it, it just depends on how you hold the sample whether it needs more red or more green. With the new lamp you can tell just what is wrong without any trouble. It is a good thing, too, to check up the change in artificial light. I did get rid of Acid Violet 4B long ago, but there are a few others that are likely to follow because they turn red in artificial light, and the shades made with them change during the day according to the light.

Whizzers

November 27.—The increase in the work forced us to get another whizzer. All the old ones were the regular old-time engine driven with all the machinery overhead. We would get grease on the goods every once in a while no matter how careful we were. This new one is electric and has everything under the basket. When it is running at full speed with a full load of goods nobody would know it either by the noise or the vibration while the old ones sound like steam rollers and shake the whole place. I found out some things about the effect of whizzing on the goods. If silk goods are not made pretty dry and are kept long before boarding they will get streaky, and if they are put into a whizzer hot they will get full of creases that are hard to get out. We used to get these on our blacks because the black had a hot finish, but as soon as we found it out and cooled the goods before whizzing there was no more trouble from creases.

Nets

December 15.—It's surprising what a lot of nets it takes to run a dyehouse, but that is on account of the different fancy shades. We can use the same ones for a lot of different shades, but you have to be careful. I once saw some smoke shades all spotted with brown because they had used two fawn nets to make up the lot. Last week I collected a lot of odd colors we weren't doing any more, and stripped them so we can use them for grays. We used to put 3 dozen pairs of ladies' stockings in a net, but now we put 5 dozen. That packs them pretty tight, but there is less trouble from unevenness than when they move around and tie themselves into knots. We had to get special nets

for chiffon goods because they wiggle out through the holes in an ordinary net, and these new ones are knit closer. When the lot is taken out of the nets for shipping, the nets ought to be well dried before they are put away or else they will get mouldy and rotten. Bleach nets must be dried and stored by themselves.

Paddle Machines

December 26.—For the last month or two I have been trying to figure out from every point of view which is the best hosiery dyeing machine. I am satisfied now that a Monel metal paddle machine with a hoisting basket has the advantage in every way for fancy colors. I will stick to the rotary for blacks and cordovans, where I can do a large lot in a short liquor and save dye, but the paddle is best for light shades. I have satisfied myself that there is less chance for unevenness and there is less wear and tear on the goods. The lot can be raised out of the liquor while a sample is being dried and while the next feed of dye is being cooked up. The steam pipe is easy to get at and the whole inside of the machine can be cleaned when it needs it. You can never clean out a rotary entirely, and when the steam pipe gets choked with lint so it boils unevenly, you have to take the whole thing apart.

Oil Finish on Silk Blacks

December 30.—Although a black on silk goods may look pretty good by itself, it really needs a finish to improve the luster and feel. For a time we used a little olive oil and soap and scrooped with formic acid, but cold weather brings out a white grease on the goods and the boxes get a little oily. That ended olive oil but we soon found a finish that was simply soap and stearic acid. Stearic acid is a solid waxy material—the same as a tallow candle. The heat of the drying boards melts it into the silk, and when it is cool it doesn't make oil spots on the boxes or show in any way. It doesn't smell either, and as far as I can see we will go on using it until something better comes along.

Dyestuffs Tables

A List of the Principal American-Made Colors with Their Properties and Fastness Characteristics

[NOTE: The publishers of The REPORTER have secured more or less complete data in regard to many of the dyestuffs which are at the present time being manufactured in the United States. As the following material has been brought together from various sources, they realize that errors are quite likely to appear, and it is earnestly requested that any readers who find errors or who are able to give additional information will communicate with the publishers in order that this material may be made as correct, complete and up to date as possible. These tables will appear serially until all colors upon which we have data shall have been covered. The publication of this data was begun in the issue of March 10, 1924.]

CRUMPSALL YELLOW
(Schultz No. 178)

COMPOSITION: Mono azo.

SPECIALLY SUITABLE FOR: Wool.

USUAL METHOD OF DYEING: Acid or chrome mordant.

SHADE: Redder than S-177.

SHADE BY GASLIGHT: No change.

SOLUBILITY: Good.

LEVEL: Same as S-177.

EXHAUSTS: Same as S-177.

FASTNESS TO:

Acid: Fast to organic acids; with mineral acids goes redder.
Alkali: Fast.
Carbonizing: Fast.
Fulling: Fast; equals S-177.
Ironing: Shade changes, but returns on cooling.
Light: Fast enough for men's wear.
Perspiration: Fast.
Potting: Fast.
Rubbing: Fast.
Scouring: Fast.
Steaming: Fast.
Washing: Fast.

SENSITIVE TO METALS, LIME: Not sensitive to lime.

MACHINE DYEING: O. K.

OTHER PROPERTIES: Fast to salt water.

DYED BY OTHER METHODS: Dyed by the silk-white process, the silk-effect threads are left clear.

ON OTHER MATERIALS: Used in calico printing, using chrome-mordanted cotton.

COMPETING PRODUCTS: Not made in the United States.

ERIO CHROME BLUE BLACK B
(Schultz No. 180)

COMPOSITION: Mono azo.

SPECIALLY SUITABLE FOR: Wool, especially slub dyeing.

USUAL METHOD OF DYEING: Top or bottom chrome. (In top-chroming use only one-half the quantity of chrome as of color, and never more than 2 per cent.)

SHADE: Blue gray to blue black.

SHADE BY GASLIGHT: No change in shade.

SOLUBILITY: About 8 grains per liter.

LEVEL: Excellent.

EXHAUSTS: Clear.

FASTNESS TO:
Acid: Redder.
Alkali: Very fast.
Carbonizing: Turns redder, but shade returns on neutralizing.
Cross-Dyeing: Fast to neutral cross-dyeing; not fast to acid cross-dyeing.
Fulling: Very fast; does not bleed when top-chromed.
Light: Fast enough for men's wear.
Perspiration: Fast.
Potting: Faster than Erio Chrome Black A (S-184); most fast dyed top-chrome.
Rubbing: Fast.
Scouring: Very fast.
Steaming: Turns noticeably greener, especially dyed in light percentage.
Sulphur: Fast top-chromed.

SENSITIVE TO METALS, LIME: Not as sensitive to iron or copper as S-181.

MACHINE DYEING: Better for metal machines than S-181.

DYED BY OTHER METHODS: Dyed chromate, the shade is lighter and yellower.

ON UNIONS: White cotton-effect threads are not stained.

PRINTING: Suitable for vigoureux printing; S-183 is better.

COMPETING PRODUCTS: Made in the United States by American Aniline Products, Inc.; Cincinnati Chemical Works; National Aniline & Chemical Company; United States Color & Chemical Company.

SALICINE BLACK U
(Schultz No. 181)

COMPOSITION: Mono azo.

SPECIALLY SUITABLE FOR: Woolen and worsted yarn slubbing and pieces.

USUAL METHOD OF DYEING: Top or bottom chrome. (In dyeing with this color on a chrome mordant it is essential to use a heavily reduced chrome to obtain the best results.)

SHADE: Similar to logwood, although logwood has much better covering power.

SHADE BY GASLIGHT: Redder.

SOLUBILITY: Varies with the method of manufacture.

LEVEL: Dyes level best in a weak acid bath.

EXHAUSTS: Clear.

FASTNESS TO:
Acid: Redder with mineral acids.
Alkali: Fast.
Carbonizing: Redder, but the shade returns on neutralizing.
Fulling: Very fast.
Ironing: Very fast.
Light: Excellent fastness; suitable for men's wear.
Perspiration: Excellent fastness.
Potting: Faster top chrome than bottom chrome.
Rubbing: Fast.
Scouring: Very fast.
Steaming: Goes somewhat greener.
Sulphur: Very fast.
Washing: Very fast.
Water: Stands Markischer test.

SENSITIVE TO METALS, LIME: The color is extremely sensitive to copper and iron.

MACHINE DYEING: Can be dyed in metal machines by bottom-chroming and top-chroming after.

DYED BY OTHER METHODS: Largely employed in combination with Violet S4B, Sulphon Acid Blue R, Gallocyanine and Alizarine Blues for the production of fast navy blue shades on men's wear serges.

ON UNIONS: White cotton and silk effect threads are stained.

ON OTHER MATERIALS: Silk: The color is not fast to water on this fiber.

PRINTING: The color does not keep well in solution; S-180 is better in this respect. The direct prints bleed badly into the white.

REMARKS: This color should be carefully examined for the presence of free copper, as the presence of this metal even in small amounts throws the shade of the color toward a plum shade and a good shade of blue cannot be obtained. The metal is best determined by electrical precipitation, which gives total copper.

COMPETING PRODUCTS: Made in the United States by American Aniline Products, Inc.; Amalgamated Dyestuff & Chemical Company; Butterworth-Judson Corporation; Calco Chemical Company; Central Dyestuff Company; Cincinnati Chemical Works; Commonwealth Color & Chemical Company; Consolidated Color & Chemical Company; E. I. du Pont de Nemours & Co. (zinc salt black similar to Salicine Black UL); Grasselli Dyestuff Corporation (zinc salt black similar to Salicine Black UL); National Aniline & Chemical Company; Newport Chemical Works; New England Chemical Company (Selling Agents, J. R. Smith); Palatine Aniline Company; United States Color & Chemical Company; Sherwin-Williams Company.

BRILLIANT SULPHON RED B
(Schultz No. 182)

SPECIALLY SUITABLE FOR: Wool.

USUAL METHOD OF DYEING: Glauber salt and sulphuric acid.

SHADE: Bright red, bluish cast.

SHADE BY GASLIGHT: Yellower.

SOLUBILITY: Good.

LEVEL: Dyes level.

EXHAUSTS: Well.

(Continued on page 540)

Technical Notes from Foreign Sources

Washing and Drying Artificial Silk Bobbins

Immediately after the operations of squirting and coagulation, the artificial silk fibers are wound up on bobbins, which are then placed around the circumference of a circular frame which revolves in a vertical plane about a horizontal axis partly enclosed within an outer cover. British Patent No. 199,355 is concerned with a process for rapidly and economically washing these bobbins. Water is sprayed on the bobbins while the frame is rotating slowly, and afterward the rate of rotation is considerably increased so that the water is expelled. These alternate operations of washing by spraying and centrifuging are repeated until the artificial silk is thoroughly washed and dried.

Affinity of Wool for Acid and Basic Dyes

An investigation has been made and reported in the Journal of the Society of Dyers and Colorists, 1924, pages 77 to 79 on the relation that exists between the nitrogen of wool and its affinity for acid and basic dyestuffs. Samples of ordinary wool and deaminated wool were dyed under similar conditions. Various dyestuffs, such as Acid Magenta, Orange II, Fast Red A, Fast Red, Indigo Carmine and Methylene Blue were used in the experiments. In each case the quantity of dyestuff absorbed by the wool was determined by titration of the residual dye liquor with titanous chloride. This is in accordance with the method of Knecht and Hibbert.

The results that were obtained in this series of experiments may be summarized as follows. Except in the case of Fast Red deaminated wool possesses the same degree of attraction for the acid dyestuffs as ordinary wool. On the other hand, the affinity of the deaminated wool for the basic dyestuffs is increased. Furthermore, the affinity of the wool for acid dyestuffs, such as Fast Red A and Indigo Carmine was not affected by previous treatment with aldehydes and ketones, such as formaldehyde and quinone, or by oxidation with potassium persulphate. The deamination of the wool was effected by treating it with cold nitrous acid and then boiling.

The nitrogen contents of three samples of ordinary and deaminated wool were 15.96, 15.70, 16.94 and 15.51, 15.29 and 16.78 per cent respectively. When boiled in water for one and one-half hours, wool lost 0.065 per cent of nitrogen.

Loading Silk

French Patent No. 557,815 is concerned with a process for weighting silk in which complex organic salts of tin are used in place of the ordinary tin loading salts.

The salts of this metal with various organic acids, when dissolved in water, hydrolyze, and a part of the tin is separated in the form of stannic acid. This substance does not penetrate into the silk fiber by a process of diffusion, but is fixed on the surface of the fiber.

The invention herein described uses organic salts of tin of rather complex character and hitherto unknown. Such salts as sodium hexa formiostannate may be mentioned. This salt is formed by the reaction between sodium fermate and tin perchloride. The equation of the reaction may be written as follows:

$$6H.COONa\ SnCl_4 + H_2O = Na_2Sn(HCOO)_6.5H_2O + 4NaCl + H_2O.$$

In practice the complex salt of tin is prepared on the fiber itself by first soaking the same in a solution of sodium formate and then in a bath of tin perchloride. By subsequent treatment with water colloidal stannic acid is formed in the interior structure of the fiber and the silk is weighted but still retains its luster. Furthermore, the amount of weighting matter added to the silk fiber is much greater than is usual when using tin perchloride as a loading agent, and the strength of the fabric is retained even after prolonged exposure to light and air.

In order to carry out this process it is essential to use a concentrated solution of an alkaline formate, such as sodium formate, lithium formate, potassium formate or ammonium formate, which can be slightly acidulated with formic acid or acetic acid. After the fiber is immersed in this solution, the silk is centrifuged and then impregnated with a solution of tin perchloride to saturation. Hydrolysis of the tin salt is then effected by washing in water and the stannic acid is fixed on the fiber by passing the fabric through a bath of sodium phosphate. After four such successive treatments, the quantity of loading material in the fiber will amount to 100 per cent. A salt of zirconium may be employed in the place of tin.

Dyeing of Cotton, Flax and Hemp

A study has been made of the differences in the dyeing of the three fibers, cotton, flax and hemp, and the results have been reported in the Kolloid Zeitung, 1924, pages 181-186.

The dyeing was carried out with direct cotton dyestuffs. The dye baths contained various amounts of sodium chloride, sodium sulphate and sodium carbonate. In general, to obtain maximum dyeing, flax requires 9 per cent and hemp 12 per cent less added salt than cotton. This indicates that cotton will take up a more coarsely dispersed dyestuff than the other fibers. Flax is intermediate between hemp and cotton in this respect. It was found that these differences are not dependent on the degree of swelling, which is the same for all in water, but are ascribed to differences in the size of the canals or intercellular spaces which limit the size of the dyestuff particle which can be absorbed.

Foreign Dyes Imported Through the Port of New York During July

Compiled by the Chemical Division of the Bureau of Foreign and Domestic Commerce in Collaboration with the Chemical Division of the United States Tariff Commission

KEY TO ABBREVIATIONS FOR FOREIGN MANUFACTURERS

1—The Six Leading German Companies

A—Actien-Gesellschaft fur Anilin-Fabrikation, Berlin. Founded 1873. Branches in France and Russia.
B—Badische Anilin-und Soda-Fabrik, Ludwigshafen on the Rhine. Founded 1865. Branches in France and Russia.
By—Farbenfabriken vorm. Friedr. Bayer & Co., Leverkusen on the Rhine. Founded 1862. Branches in France and Russia.
C—Leopold Cassella & Co., Frankfort on the Main. Founded 1870. Branches in France and Russia.
K—Kalle & Co., A. G., Biebrich on the Rhine. Founded 1870. Branches in Russia.
M—Farbwerke vorm. Meister Lucius & Bruning, Hochst on the Main. Founded 1862. Branches in France and Russia.

2—The Seven Smaller German Companies

BK—Leipziger Anilinfabrik Beyer & Kegel, Furstenberg near Leipzig. Founded 1882.
GG—Chemikalienwerk Greishem G.m.b.H., Griesheim on the Main. Founded 1881.
CJ—Carl Jager G.m.b.H., Anilinfarbenfabrik, Dusseldorf. Founded 1823.
GrE—Chemische Fabrik Griesheim-Electron, Offenbach on the Main. Founded 1842.
L—Farbwerk Muhlheim vorm. A. Leonhardt & Co., Muhlheim on the Main. Founded 1879. Branch in France.
tM—Chemische Fabriken vorm. Weiler ter Meer, Uerdingen on the Rhine. Founded 1877.
WD—Wulfing, Dahl & Co., A. G. Barmen. Founded 1842.

3—Dutch, Belgian and French Companies

FA—Farbwerk Ammersfoort, Ammersfoort, Netherlands. Founded 1888.
NF—Niederlandische Farbe-und Chemikalienfabrik Delft, Netherlands (Delft). Founded 1897. Branch in Russia.
LG—Lazard Godchaux, of Brussels. (These products are probably compounded largely fr the dyes made by A. Wiescher & Co., of Haeren, Belgium.)
P—Societe Anonyme des Matieres colorantes et produits chimiques St. Denis (formerly A. Poirrier), St. Denis, near Paris, France. Founded 1830.

4—Swiss Companies (all at Basel)

DH—Farbwerke vorm. L. Durand, Huguenin & Co. Founded 1871. Branches in Germany and France.
G—Anilinfarben-und Extract-Fabriken vorm. Joh. Rud. Geigy. Founded 1764. Branches in France, Germany and Russia.
I—Gesellschaft fur chemische Industrie. Founded 1885. Branch in France.
S—Chemische Fabrik vorm. Sandoz & Co. Founded 1887.

5—English Companies

BAC—The British Alizarin Co., Ltd. Established 1882.
ClCo—The Clayton Aniline Co., Ltd., Clayton, near Manchester Founded 1876.
CR—Clauss & Co. (formerly Clauss & Ree), Clayton, near Manchester. Founded 1890.
CV—Colne Vale Chemical Co., Milnsbridge, near Huddersfield.
RHS—Read Holliday & Sons, Ltd., Huddersfield. Founded 1820. (Purchases by British Dyes, Ltd.)
BD—British Dyes, Ltd Founded 1915.
Lev—Levinstein, Ltd., Crumpsall Vale, near Manchester. Founded 1864.
O—Importations of unknown source, through dealers in colors.
Lo—Charles Lowe & Co., Manchester.
Br—Brotherton & Co., Ltd., Mersey Chemical Works.

THE imports of coal-tar dyes for July, 1924, through the port of New York totaled 140,810 pounds, with an invoice value of $137,075. In addition, 2,870 pounds, with an invoice value of $2,483, were reported through the port of Boston.

Imports of Dyes Through the Port of New York, 1924

Month	Pounds	Value
January	288,743	$232,571
February	158,874	176,657
March	293,862	302,016
April	174,880	182,253
May	167,245	165,521
June	147,380	151,331
July	140,810	137,075

Five Leading Dyes by Quantity Imported

	Pounds
Indanthrene Golden Orange R	12,601
Ciba Bordeaux B	12,490
Indanthrene Golden Orange G	12,044
Indanthrene Red BN	6,430
Ciba Violet B	5,724

Per Cent of Quantity by Country of Shipment

Germany	52	Italy	2
Switzerland	32	Belgium	2
England	5	Holland	1
France	5	Canada	1

Imports of Color Lakes

January	None	None
February	4,181	$1,848
March	11,520	3,343
April	2,956	2,143
May	3,421	1,034
June	330	463
July	390	320

The dyes in this report are grouped by Schultz numbers, and in the case of those which could not be identified by Schultz number the classification according to the ordinary method of application was adopted. As the pastes and powders of the vat dyes vary widely in strength and quantity, each vat dye has been reduced — in nearly every case — to a single-strength basis.

The designation of "†" for competitive and "*" for non-competitive indicates the appraisement basis for the assessment of the ad valorem duty in paragraph 28 of the Tariff Act of 1922. Those dyes without designation are doubtful, pending further investigation.

The ad valorem rate for competitive dyes is based on the American selling price, as defined in subdivision

(f) of section 402 of Title IV; the ad valorem rate for non-competitive dyes is based on the United States value, as defined in subdivision (d) of section 402 of Title IV of the Tariff Act of 1922.

Dyes of Coal-Tar Origin

This table includes imports through the port of New York to the amount of 140,810 pounds, and also 2,870 pounds from Boston.

Schultz No.	Name of Dye and Manufacturer	Quantity (pounds)
177	Mordant Yellow Milling Yellow GA—(A)	500
182	Brilliant Sulphon Red *Brilliant Sulphon Red 10B—(S)	500
205	Diphenyl Chrysoine RR Diphenyl Chrysoine RRC—(G)	498
220	Palatine Black Wool Black GRF—(A)	500
273	Diaminogene Blue *Diaminogene Blue NA—(C)	2,044
296	Cotton Yellow †Benzo Fast Yellow RL—(By)	88
330	Zambesi Brown Zambesi Brown 2G—(A)	10
339	Diamine Orange *Diamine Orange B—(C)	1,000
358	Diphenyl Red Aceto Purpurine 8B—(A) Chloramine Red 8BS—(By) *Toluylene Red—(Gr.E.)	434
366	Delta Purpurine Delta Purpurine 5B—(By)	441
370	Brilliant Congo Brilliant Congo R—(A)	50
373	Congo Orange Congo Orange R—(By)	99
392	Toluylene Orange *Toluylene Fast Orange GL—(By)	121
400	Acid Anthracene Red Acid Milling Red R Conc.—(G)	441
456	Benzo Fast Blue †Benzo Fast Blue 4GL—(By)	1,682
462	Direct Deep Black Union Black S—(C)	300
496	Setoglaucine *Setoglaucine—(BDA)	10
503	Neptune Green Erio Viridine B Supra—(G)	551
534	Acid Violet 7B Acid Violet 7B Conc.—(B)	25
539	Soluble Blue Water Blue, large lumps—(A)	10
543	Patent Blue Kiton Pure Blue V 86%—(I) Patent Blue V—(M) Poseidon Blue BGX Conc.—(B)	1,607
545	Patent Blue A †Kiton Blue A 82%—(I)	882
552	Chromal Blue *Chromal Blue GC—(G)	220
558	Victoria Blue R Victoria Blue R 36%—(I)	110
559	Victoria Blue B Victoria Blue B, Highly Conc.—(B)	100
571	Rhodamine 6G Rhodamine 6G Extra 98%—(I)	220
573	Rhodamine B Rosazeine B Base—(M)	5
608	Euchrysine †Patent Phosphine GRNTN—(B)	680
618	Thioflavine T Thioflavine TCN—(C)	220
621	Cresyl Blue BBS *Brilliant Cresyl Blue—(BDA)	10
622	Delphine Blue B—(Q)	110
627	Anthracyanine *Anthracyanine S—(DH)	110
663	New Methylene Blue *New Methylene Blue NS Conc.—(S)	280
705	Indamine 6R Indocyanine B—(A)	1,000
759	Anthraflavone G (sgle. stngth.) Anthra Yellow GC Paste—(B) Anthra Yellow GC Powder—(B)	1,475
760	Indan. Golden Orange G (sgle. stngth.) Vat Golden Drange G Dbl. Pst.—(B) Vat Golden Orange G Dbl. Pst. 20%—(B) Vat Golden Orange IG Dbl. Pst. 20%—(M) Vat Golden Orange G Powder—(B)	12,014
761	Indan. Golden Orange R (sgle. stngth.) Indan. Golden Orange RRT Pst.—(B) *Vat Orange RRT Pst. 10%—(B) Vat Golden Orange RRT Pst.—(B) Vat Golden Orange IRRT Pst. 10%—(M) Vat Golden Orange RRT Powder—(B)	12,601
762	Indan. Scarlet GS Powder Vat Orange 4R Powder 50%—(B)	330
774	Alizarine Black Alizarine Black WR 40% Pst.—(B) Alizarine Black WX Ex. S 40% Pst.—(B)	853
782	Alizarine Brown Anthracene Brown SW 80% Pdr.—(B)	200
785	Alizarine GI 20%—(B)	441
787	Alizarine Bordeaux Alizarine Bordeaux BP 20%—(By)	661
794	Cibanone Black (sgle. stngth.) Cibanone Black 2G Pdr. 84%—(I)	771
795	Cibanone Yellow R (sgle. stngth.) Cibanone Yellow R Pdr. 81%—(I)	2,864

Schultz No.	Name of Dye and Manufacturer	Quantity (pounds)
797	Alizarine Garnet	250
	Alizarine Claret R Paste—(M)	
798	Alizarine Maroon W	432
	Alizarine Maroon Paste 20%—(B)	
804	Alizarine Blue S	1,344
	*Alizarine Blue S Powder—(By)	
819	Algol Red FF, R	399
	*Algol Red R Ex. Pst. 12½%—(By)	
820	Algol Brilliant Violet R (sgle. stngth.)	400
	Vat Brilliant Violet RK Powder—(By)	
822	Algol Brilliant Orange FR (sgle. stngth.)	2,452
	Vat Orange RRK Pst. 12½%—(By)	
	Vat Orange RRK Paste—(B)	
830	Indan. Red R (sgle. stngth.)	897
	Anthra Red RT Paste—(B)	
831	Indan. Red BN (sgle. stngth.)	6,430
	*Duranthrene Red BN 10% Pst.—(BD)	
	*Indan. Red BN Ex. Pst.—(B)	
	*Indan. Red BN Ex. Pdr.—(B)	
	Vat Red BN Ex. Paste—(B)	
	Vat Red RK Paste—(B)	
	Vat Red RK Paste 10%—(B)	
832	Indan. Violet RN (sgle. stngth.)	330
	Vat Violet BN Paste—(B)	
838	Indan. Blue RS (sgle. stngth.)	1,200
	†Indan. Blue RS Triple Powder	
840	Indan. Blue G (sgle. stngth.)	400
	†Vat Blue 3G Paste Fine—(B)	
842	Indan. Blue GCD (sgle. stngth.)	4,043
	Indan. Blue GCD Dbl. Pst.—(B)	
	Vat Blue GCD Dbl. Pst. Fine 17%—(B)	
	Vat Blue GCD Dbl. Pst. Fine 10%—(B)	
855	Alizarine Pure Blue B	2,305
	Alizarine Sky Blue B Powder—(By)	
	*Alizarine Sky Blue B Pdr. 70%—(By)	
	*Alizarine Sky Blue B Pdr. 75%—(By)	
856	Alizarine Astrol	500
	Alizarine Astrol B Powder—(By)	
	*Alizarine Astrol B Powder 40%—(By)	
858	Alizarine Saphirol B	2,153
	†Alizarine Light Blue B Conc.—(S)	
	†Alizarine Light Blue SE Conc.—(S)	
	Alizarine Blue SAWSA Pdr.—(By)	
860	Cyananthrol G	711
	Alizarine Direct Blue BGAOO—(B)	
	Cyananthrol BGAOO—(B)	
862	Alizarine Blue Black	4,641
	†Alizarine Blue Black B Powder—(By)	
	Alizarine Blue Black B Powder 80%—(By)	
867	Indan. Brown B (sgle. stngth.)	878
	Anthra Brown B Dbl. Pst. 10%—(B)	
869	Algol Brown R (sgle. stngth.)	176
	*Algol Brown R Powder—(By)	
870	Algol Corinth R (sgle. stngth.)	3,192
	Vat Corinth RK Powder—(By)	
874	Indigo, Synthetic	25
	Indigo Solution 20%—(B)	
876	Indigo, White	5
	Indigosol O—(M)	
881	Ciba Blue 2B (sgle. stngth.)	210
	Ciba Blue 2BD Paste 16%—(I)	
	Brilliant Indigo 4B Powder—(B)	
883	Indigo KG (sgle. stngth.)	750
	Indigo MLB, 6B Powder—(M)	
885	Brilliant Indigo BD (sgle. stngth.)	418
	Brilliant Indigo B 20%—(B)	
895	Alizarine Indigo 3R (sgle. stngth.)	750
	Alizarine Indigo 3R Powder—(By)	
897	Ciba Heliotrope B (sgle. stngth.)	1,826
	Ciba Heliotrope B Powder 83%—(I)	
901	Ciba Violet B (sgle. stngth.)	5,724
	Ciba Violet B Powder 71%—(I)	
	Ciba Violet R Paste 20%—(I)	
910	Helindone Pink (sgle. stngth.)	2,000
	Anthra Pink BN Paste 10%—(B)	
	Helindone Pink AN Paste 10%—(M)	
912	Thioindigo Red B	551
	Ciba Pink B 20% Paste—(I)	
918	Vat (Helindone) Red 3B Pst. 20%—(M)	500
919	Ciba Bordeaux B (sgle. stngth.)	12,490
	Ciba Bordeaux B Powder 96%—(I)	
923	Ursol	200
	Fur Blue Black SB—(A)	
	Fur Brown 4R Paste—(A)	

UNIDENTIFIED DYES

Acid Dyes

Name of Dye and Manufacturer	Quantity (pounds)
Cashmere Black TN 70%—(By)	300
Guinea Fast Red 2R—(A)	300
Milling Orange G—(A)	5
Milling Yellow F3G—(A)	100
Milling Yellow R—(A)	5
Onis (Anthosine) Violet BB—(B)	25
Wool Fast Blue BL—(B)	333
Wool Fast Scarlet Conc.—(G)	55

Vat Dyes

Brilliant Indigo 4BG Paste 20%—(B)	476
Cibanone Blue 2G Powder 73%—(I)	55
Cibanone Orange 3R Powder 86%—(I)	55
Cibanone Orange 6R Powder 85%—(I)	55
Cibanone Red C Powder 85%—(I)	55
Hydron Pink (sgle. stngth.)	1,045
Hydron Pink FF Paste—(C)	
Hydron Pink FF Powder—(C)	
Hydron Scarlet (sgle. stngth.)	520
Hydron Scarlet 3B Paste—(C)	
Hydron Scarlet 3B Powder—(C)	

Name of Dye and Manufacturer	Quantity (pounds)
Hydron Sky Blue FK Paste—(C)	820
*Hydron Wool Olive B 12%—(C)	25
Hydron Yellow NF Paste—(C)	200
Vat (Indan.) Blue BCD Dbl. Pst. Fine 20% —(B)	1,512
Vat Blue BGCS 60% Powder—(B)	10
Vat Blue RC Dbl. Paste (sgle. stngth.)—(B)	2
Vat Brilliant BBlue R Paste 10%—(B)	132
Vat Brilliant Blue R Paste Fine 10%—(M)	250
Vat Brown GG (sgle. stngth.)	180
Vat Brown GG Paste 10%—(B)	
Vat Brown IGG Paste 12½%—(M)	
Vat Brown IR, IGR Paste 10%—(M)	700
Vat Fast Scarlet G Paste 10%—(M)	500
Vat Khaki C in Grains 40%—(M)	10
Vat Orange 3R Paste Fine 10%—(B)	432
†Anthra Pink R Extra Paste 10%—(B)	1,000
*Vat Pink B Dbl. Paste (sgle. stngth.)—(B)	4,416
Vat Red Violet (sgle. stngth.)	878
Vat Red Violet RRK Paste—(B)	
Vat Red Violet RRK Paste Fine 10%—(B)	
Mordant and Chrome Dyes	
Acid Alizarine Gray G	1,110
Acid Alizarine Gray G—(M)	
Acid Alizarine Gray G 80%—(M)	
Brilliant Chrome Blue 2B—(DH)	110
Chrome Azurine G 65%—(I)	243
Chromorhodine	330
*Chromorhodine BN—(DH)	
*Chromorhodine 6GN Extra—(DH)	
Chromovesuvine RA—(DH)	110
Metachrome Brilliant Blue BL—(A)	100
Metachrome Olive D, 2G—(A)	1,100
*Metachrome Olive Brown G Powder—(Bro.)	1,000
Pilatus Chromate Black B—(B)	1
Basic Dyes	
Acridine Yellow AO—(M)	20
Methylene Blue G 44%—(B)	200
Sulphur Dyes	
*Cross Dye Green B 100%—(BD)	1,720
Immedial Purple C—(C)	500
Katigene Indigo CLGG Extra 25%—By)	882
Sulphide Direct Blue R Conc.—(M)	10
Sulphide Green BL Extra Conc.—(M)	10
Sulphide Green GL Extra Conc.—(M)	10
Sulphide New Blue BL Conc.—(M)	10
Sulphide New Blue CL Conc.—(M)	10
Sulphide New Blue JL Extra Conc.—.(M)	10
Direct Dyes	
Benzo Fast Heliotrope BL 40%—(By)	425
*Benzo Heliotrope BL—(By)	220
Benzo Rhodamine Red B, 3B 30%—(By)	125
*Blue IIII—(BC)	360
Brilliant Blue G 80%—(By)	551
*Brilliant Fast Blue 3BX 60%—(By)	99
Brillianton Orange R—(A)	10
*Chloramine Light Gray B Conc.—(S)	200
Chlorantine Fast Brown	4,850
Chlorantine Fast Brown 3GL 94%—(I)	
Chlorantine Fast Brown RL 79%—(I)	
Chlorantine Fast Gray B 98%—(I)	220
Chlorantine Fast Yellow 4GL 79%—(I)	1,102
Cotonerol A, AV Extra—(A)	120
†Cotton Red 4BX—(B)	500

DYESTUFF TABLES

(*Continued from page 535*)

FASTNESS TO:

Acid: Same as Azo Eosine (S-94) and Azo Crimson (S-64).
Alkali: Turns brown first, then blue.
Chlorine: Fast.
Fulling: Not fast; even after-chromed the color bleeds into white.
Ironing: Fast.
Light: Better than Azo Crimson.
Potting: Not fast.
Rubbing: Fast.
Scouring: Not fast; bleeds off.
Sulphur: Fast.

OTHER PROPERTIES: The shade is brighter than Azo Crimson (S-94).

DYED BY OTHER METHODS: With Glauber salt and acetic the color does not exhaust well and the shade is weaker. By top-chroming the shade is converted into a reddish brown and is no faster in any respect.

ON UNIONS: Cotton-wool unions: The cotton is left white. Wool-silk: The wool is dyed fuller and yellower than the silk.

ON OTHER MATERIALS: On silk a bright fiery blue shade of red is produced. Silk is best dyed with sulphuric acid. The fastness to water on this fiber is very moderate.

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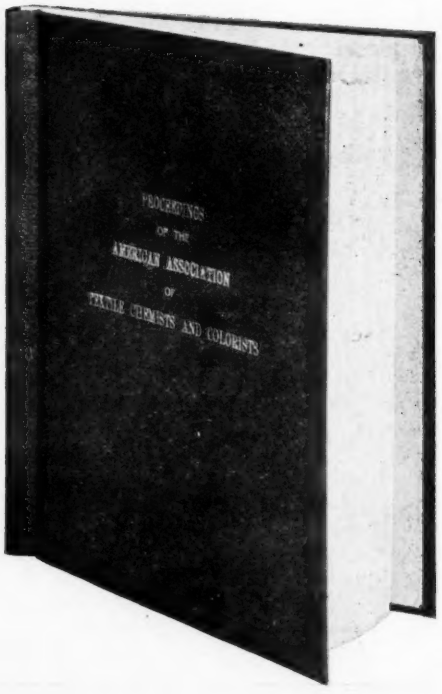

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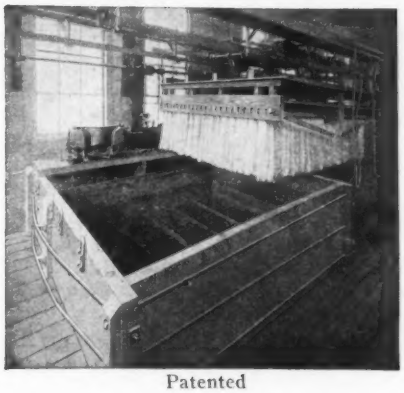

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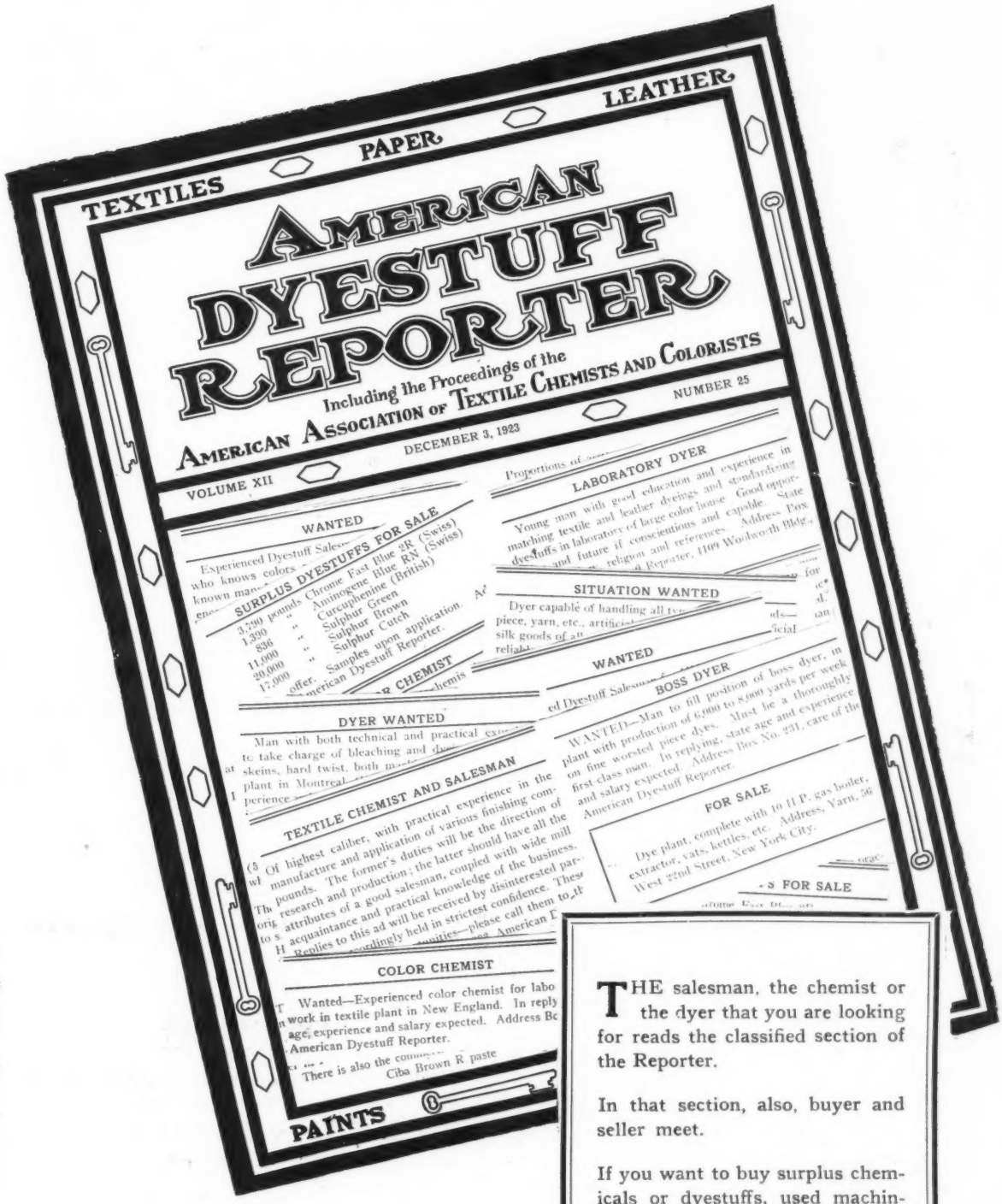

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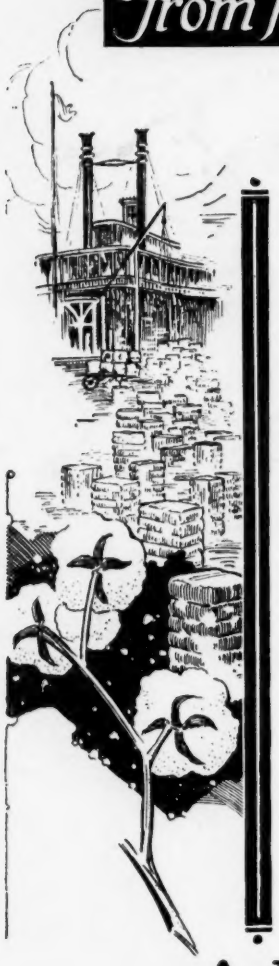

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